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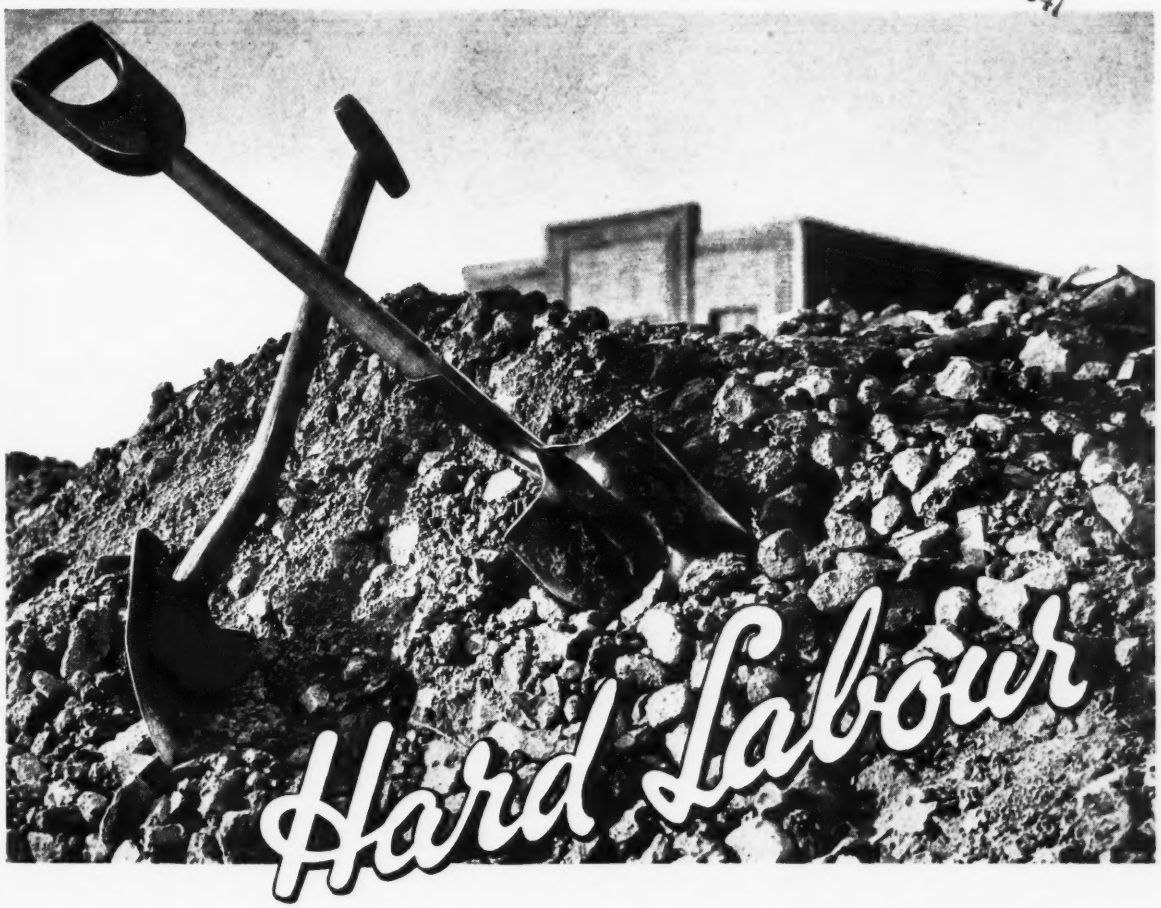

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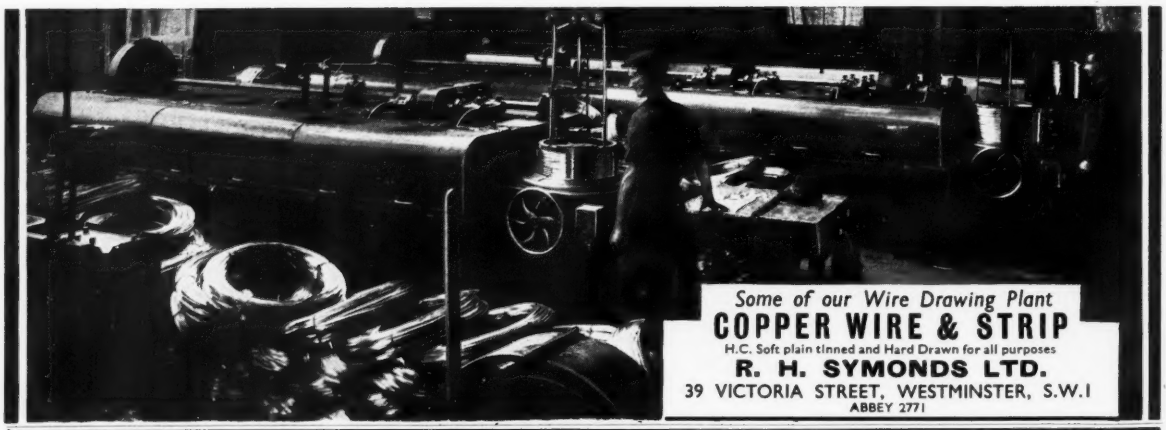
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THE
ELECTRICAL REVIEW

Volume CXXVIII — No. 3298

Friday, February 7th, 1941

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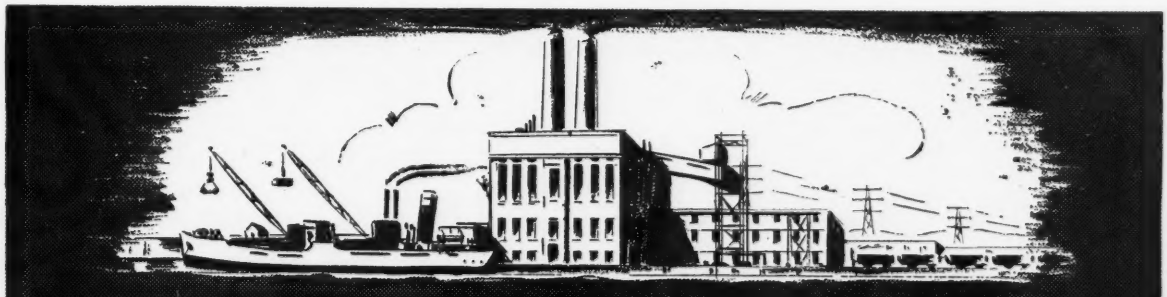

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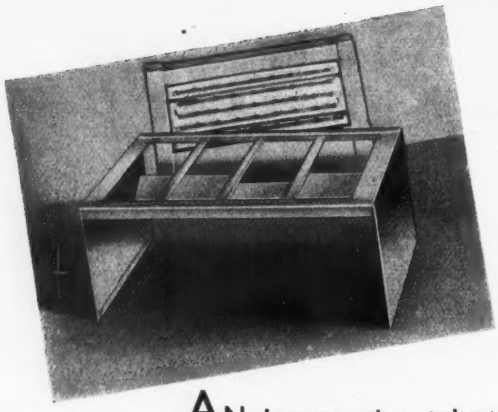

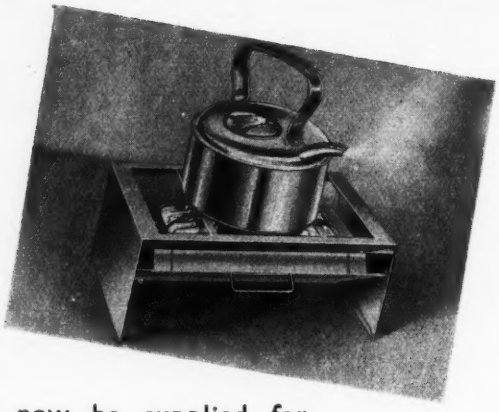

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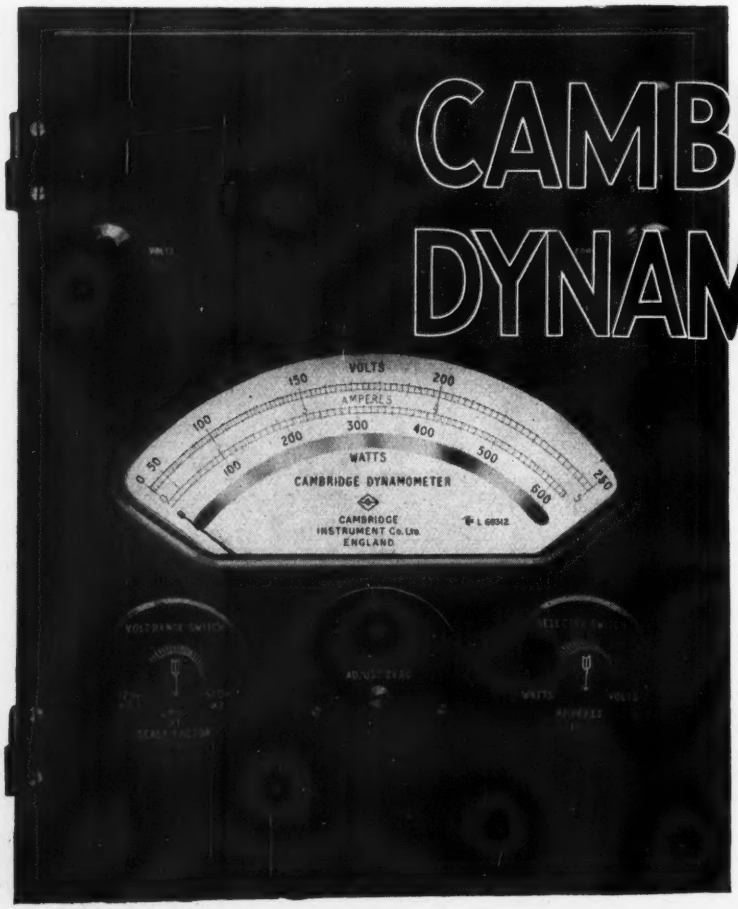

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THE
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THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

Vol. CXXVIII. No. 3298 FEBRUARY 7, 1941 Price SIXPENCE

Cable Progress

Some Suggested Reforms

THERE are two principal ways of making progress in engineering. One is to take the utmost advantage of what already exists. The other is to look out for something new that is, preferably, in the natural sequence of evolution from present practice. Both lines of advance can, and do, occur simultaneously. As an example of the first, we have the kind of selection of the fittest to survive among various methods that forms the basis of the work of the British Standards Institution. In such cases the benefits of uniformity are generally agreed to outweigh the advantages of diversity of ideas. In the second category come the results of research which have not yet reached the stage at which standardisation can be profitably applied.

After more than half a century of electricity distribution, much greater conformity with approved methods might have been expected than is to be found to-day. This shortcoming is the more noticeable in view of the many criticisms of the high costs of distribution that have been made in the past few years.

Too Many "Specials"

An important obstacle to improvement has been local individual preferences (mere whims in many cases) which have called for variations from the normal in details of cables, transformers and other plant and accessories. These have kept up the cost of production disproportionately and rarely bring advantages that make them worth while. A few cases may require special designs, but these should be regarded as abnormal and paid for accordingly.

One obvious way of lowering costs is to reduce the number of cable conductor sizes, too many of which are permitted as standards under B.S.S. 480. The position was further complicated by the preference of many supply engineers for the superseded B.S.S.7., but the latter has now, fortunately, been quashed by the Electricity Commissioners as a war measure in the interest of economy in material and labour.

It is common knowledge that the current Specification has not proved generally acceptable and no doubt, but for the war, it would have been revised. In this connection, the suggestions with regard to economy and simplification in manufacture made by Mr. H. J. Allcock in his chairman's address to the I.E.E. Transmission Section are very much to the point. He would use shaped conductors only and would eliminate many conductor sizes now standard, the "460-V" cable (in favour of that now termed "1,000-V") and cable designed for working on non-earthed systems. He would also abandon the method of distinguishing cores by colours and substitute a less complicated system of reference by numbers.

His views are thus closely in accord with those expressed in our issue of June 7th last by Mr. S. W. Melsom, who went even further in some respects and dealt also with the standardisation of accessories, including feeder pillars and h.r.c. fuses.

Armour and Safety

Another war economy to which Mr. Allcock refers is the enforced use of non-armoured cables. Experience with these will show whether the factor of safety has thereby been seriously diminished, and the views expressed by Mr. R. W. L. Phillips in the ELECTRICAL REVIEW of January 10th are of especial relevance to this question, another aspect of which is put forward by a correspondent in this issue.

As to research, the best prospects are in connection with the higher voltages. Without anticipating any very material departure from present methods of overhead transmission, we should expect the greater loads of the future to call for the laying of cables in urban areas for much higher voltages, if only on account of space limitations. Yet the elaborate precautions now necessary against the ionisation of vacuous spaces in cables operated at more than 22 kV form an expensive obstacle to their fuller use. Mr. Allcock forecasts the development of new dielectric material that will result in a reversion to the relative simplicity of the straight cable.

Research efforts are owed to a few and their fruits cannot be taken for granted. Where the many can help is in accepting what is authoritatively regarded

as the best compromise to suit the greatest number of distribution networks. If this frame of mind can be encouraged in the stress of present circumstances, the holding up of the much needed new cable Specification will not have been altogether a loss.

Overseas Trade in 1940

STATISTICS relating to overseas trade in December issued by the Board of Trade show that although the value of exports of electrical goods and apparatus (£848,051) was higher than in the preceding month, it showed a decrease of £115,985 as compared with the figure for December, 1939. Nevertheless for the whole of 1940 there was an advance in the total from £11,253,362 to £13,230,656. The figure for 1938 was £13,430,405. On the import side the December value of electrical goods and apparatus was £114,308 and was thus £190,046 less than the total for December 1939. For the year the total was £3,102,161 which represented an increase of £300,125 as compared with 1939. As we have pointed out on previous occasions, the values of electrical machinery exports and imports are not now given separately but are classed together with other machinery of all types. It may give some indication of the position, however, if the total for the machinery class is given. For December the export total was £1,889,184 which was £1,764,596 less than in December, 1939. For the whole of the year the value was £36,575,053, against £47,398,109. Imports of machinery were valued at £3,482,654 (£1,756,472 increase) in December, and £34,932,972 (£10,393,971 increase) for the twelve months.

Church Lighting

THE possibility of restoring many churches that have been damaged by enemy action makes of particular importance the regulations for the installation of electric light (and incidentally also of power and heating) that have been drawn up by the Central Council for the Care of Churches. While the over-riding requirement is that all work shall comply with the I.E.E. Regulations, there are many features that call for special provision, not only with a view to securing safety from shock and fire but also to preserving appearances. There is one stipulation which is not peculiar to churches and which could with advantage be made of more general application; that is the obligation to exhibit at distribution boards a schedule of the lights controlled from each pair of fuses and the size of fuse wire to be used in each case, accompanied by a caution against the use of any other sizes. This stipulation goes further than the terms of No. 612 (D) of the I.E.E. Regulations and seems more suitable for most purposes.

Power Engineers' Salaries

COMMENTING upon the recent decision of the National Joint Board of Employers and Members of Staff (Electricity Supply Industry) to exclude the effects of increased taxation from the calculation of the rise in the cost of living in connection with salary adjustments, the *Electrical Power Engineer* says that after weighing the employers' contentions very carefully the staff side decided to support the motion and it was carried without dissent. It is believed that members of the Electrical Power Engineers' Association will approve the action taken, "not only because of its reasonableness, but also as a gesture on the part of supply engineers that they are prepared to shoulder some of the burden of the increased taxation necessary for the successful prosecution of the war." It is not thought that the effect upon salaries will be serious, but the journal agrees with us in suggesting that deciding what portion of the higher cost of living is due to taxation will not be easy.

Falling into Line

ABOUT three years ago the Electrical Power Engineers' Association made a claim for increased salaries for members employed by Aberdare U.D.C. The claim was rejected and the Council also decided to resign from the National Joint Board. After further unsuccessful negotiations the Association decided to refer the matter to the Minister of Labour in accordance with the Conditions of Employment Order. Being the first of its kind, this was regarded as a test case; several similar references are being made. The Minister referred the matter to the National Arbitration Tribunal but before the Tribunal's hearing it was announced that the Council had given in and was to meet the claim of the E.P.E.A. as from April 1st, 1940. It will be interesting to see what effect this has upon other undertakings which are unwilling to fall into line with the majority.

Pulverised Fuel and Ash

THE question as to whether present methods of evaluating coal for stoker firing are adequate when pulverised fuel is used was raised by Mr. E. G. Bailey at the recent annual meeting of the American Society of Mechanical Engineers. A peculiarity of slag from pulverised fuel furnaces is that it tends to indicate a considerably higher iron content than that of the original coal, the reason being that the heavier pyrites fall into the slag bed and the particles containing iron tend to adhere more readily to surfaces, while ash in the tube bank has usually much the same iron content as the coal. Further up, where an oxidising atmosphere is found, fusing temperatures reach far higher values than they would in a reducing atmosphere. Available data on the subject certainly seems to support Mr. Bailey's contention that further investigations should be made into the fusing temperatures of ash and slag.

Welding Power Factor

IT is not usually regarded as worth while to raise the low power factor of individual welding machines in view of the large proportion of time in which they are idle. Recent experience in the United States indicates that where welders are worked together in groups, even in widely varying conditions, the cost of capacitors built into the machines may be justified. It is claimed that the kVA input to the transformer is substantially less than that observed with DC welding from AC mains. An example has been cited of a group of ten 500-A welders (six on and four off at any given time) which operate at an average power factor of 96 per cent. as against 83 per cent. obtained with the same number of 400-A welders fed from an AC-DC motor generator and doing equivalent work. Such groups are larger than are found in normal practice in this country, but there seems to be a possibility of a more extended use of capacitors.

A Works Supply Scheme

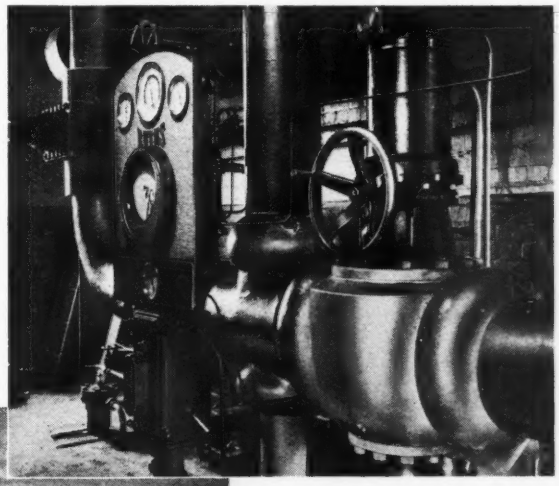
Combination of Private and Public Power

AT the Carlisle artificial silk and cotton mills of Ferguson Brothers, Ltd., a scheme is being instituted to meet in the most efficient and economical manner the works demands for both electricity for power drives and steam for process heating. The scheme, which has now reached the first stage of completion, really forms part of the modernisation of the steam and electrical installations throughout the mills, which has been in progress for some years, embracing a fuller use of electricity for power driving.

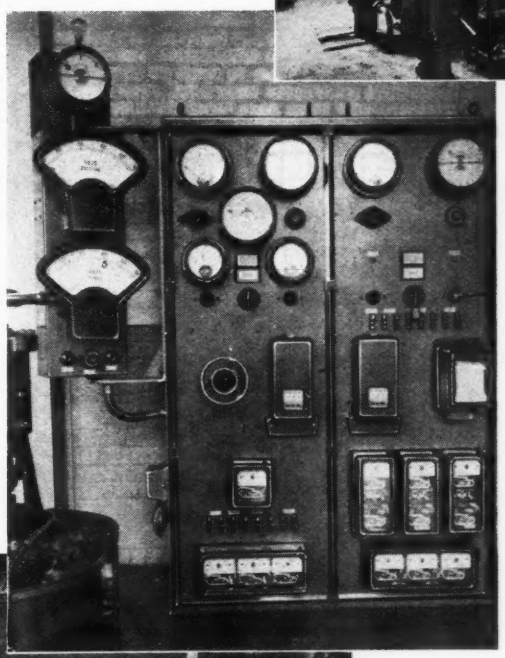
In this article we describe the measures taken and projected to bring the generation of both steam and electricity into line with the more advanced ideas on these subjects, at the same time "balancing" these supplies with a public electricity supply in the sense that each of the three can be regarded as complementary to the others and as contributing its due share to the scheme as a whole.

Immediately before the new scheme was launched the electrical installation was served entirely from the public supply, and there still remained some of the older steam drives to be converted to the modern method. Process steam was supplied by two batteries of Lancashire boilers, one serving the "Old Side" of the mills operating at 65 lb. per sq. in. and the other serving the "New Side" at 115 lb. per sq. in. The two pressures at which steam is now used throughout the mills are 65 lb. and 30 lb. per sq. in., but originally the steam supply systems on the Old and New Sides were quite independent and the lower pressure had only been introduced on the New Side where there had already been installed a Ruths accumulator taking steam directly from the 115 lb. boilers and delivering it at the 30 lb. pressure.

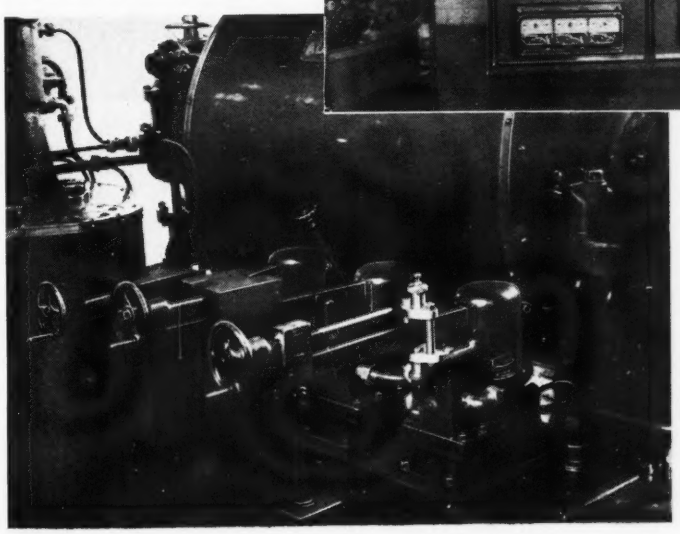
As a preliminary measure to the installation of the turbine plant, affording also greater flexibility and efficiency of steam production, the Old and New Sides were first linked together by a 10-in., 30-lb. main and as much as possible of the steam using plant on the Old Side was connected to work at this pressure. In this way it was rendered possible to supply the 30 lb. steam demand on the Old Side up to the full capacity of the New Side boilers, so increasing the quantity of steam available for electrical generation and extending the sphere of usefulness of the accumulator.



The control panel and valves for regulating process steam supplies from the Ruths accumulator



Right: The turbine-room controls where private and public supplies are synchronised. Below: Oil relays of the turbine governor control scheme for varying the alternator load with the works steam demand



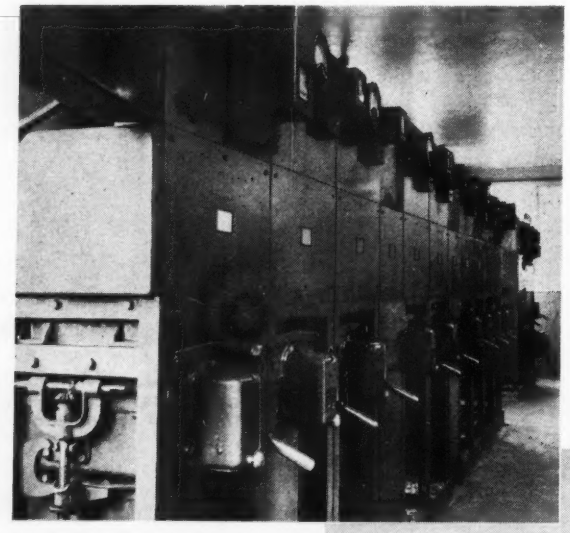
A make-up by-pass connection controlled by an "Area" valve is provided from the 65 lb. Old Side boilers to the 30-lb. steam system on the Old Side to enable the supply there from the New Side boilers to be supplemented when necessary. Ultimately, a second steam interconnector between the two sections of the mills at the pressure of 110 lb. will be added, enabling the boiler plant on the Old Side then to be shut down altogether.

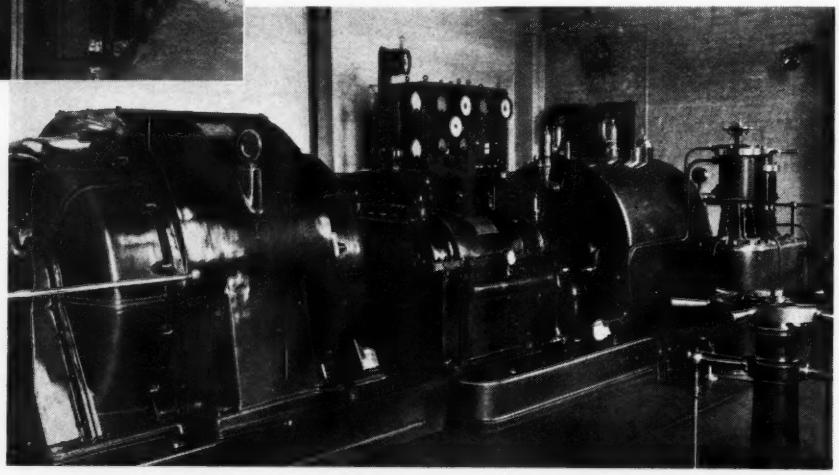
The scheme as at present envisaged comprises a 1,250-kW maximum continuous rating pass-out back-pressure turbo-alternator set running in parallel with the public supply, taking steam from future boilers to work at 375 lb. per sq. in., passing out at 110 lb. to the accumulator inlet and high-pressure process line, and exhausting the remainder at the lower process steam pressure of 30 lb.

The first stage of the scheme, however (now completed and in successful operation), provides

for only 600 kW for private generation and for feeding the turbine with steam from the existing 115-lb. boilers. This condition is arranged for by blanking off the high pressure portion of the turbine and supplying it with steam through what will ultimately form the pass-out main and governor valve.

The turbine, a Daniel Adamson product, is a five-stage impulse machine, two in the high pressure portion and three in the low pressure end, and it runs at 6,000 RPM. Two automatic partial load nozzle cut-out valves are fitted at the high pressure inlet end and one hand-operated valve—the latter for use under seasonal variations in steam demand. The speed is reduced to the alternator speed of 1,500 RPM by transmission through a Power Plant double helical gearing. The Mather and Platt alternator is of the salient-pole type and generates at 400 V, 3 phase.





The main switchboard fed from both private and public supplies in parallel and (right) the 1,250-kW pass-out back-pressure turbo-alternator set for private generation, viewed from the alternator end

The low-pressure end of the turbine has been designed to pass under present conditions a maximum of 42,000 lb. of steam per hour, and the designed inlet steam temperature is 434 deg. F. at the pressure of 110 lb. per sq. in. The degree of superheat was fixed so as to reproduce as nearly as possible the steam state at the pass-out under the final conditions which in turn was designed to leave the steam with a limited amount of superheat at the final exhaust pressure. It should here be remembered that this pressure of 100 lb. will be the pass-out pressure of the turbine when it is brought into maximum operation by the use of the high-pressure stages, and in this way the reader will obtain a correct picture of how the present stage of working is but a stepping-stone to the final scheme of operation.

Probably the most interesting part of the scheme is the arrangement of automatic control applied to the governing of the turbine. The first requirement to be met was that the turbine should be able to take its place beside the existing steam accumulator, and the low pressure end had to work in parallel with it (*i.e.*, using the same pressure range), without interference with its operation. The second was that there should be no waste of steam by discharge to atmosphere.

To meet these conditions the turbine was provided with a back-pressure governing device which causes the intake of steam to the low-pressure end of the turbine both under the present and future conditions to vary in accordance with the variation of the low-pressure steam demand of the mills as reflected by small changes in the pressure at the turbine exhaust. Thus more or less electrical load is automatically thrown on the alternator as the works low-pressure steam demand increases or lessens. This is accomplished by means of a pressure diaphragm device at the turbine which transmits the steam pressure variations to the oil-pressure system of the turbine.

With a system of this kind there must, of course, be a separate source of electrical energy to maintain a balance and this is afforded by the public supply with which the turbo-alternator normally runs in parallel. The turbine is, however, provided with a speed governor of the usual form so that in emergency it could be run independently of the outside supply with the pressure governing device inoperative.

To prevent the back-pressure governing device causing the turbine to usurp the function of the accumulator of carrying the peaks of steam demand—as it would otherwise do under certain conditions, leading among other things to peak demands on the boilers—a second diaphragm device is fitted which has the effect of reducing the intake of steam to the low-pressure end of the turbine (over-riding the back-pressure governor) should the pressure at the low-pressure inlet (*i.e.*, the pass-out point under the future conditions) tend to fall below the predetermined level.

Under the future conditions when the high-pressure stages of the turbine are in use, admission of steam to the turbine will normally be controlled by a third diaphragm device arranged to give inlet-pressure governing; *i.e.*, the intake of steam to the turbine, up to its nozzle capacity, will be governed by the firing rate of the boilers which in turn is dictated by the total process steam requirement of the mills. To provide for times when the firing rate may have to be greater than the high-pressure nozzle capacity of the turbine a by-pass " overflow " valve will be connected between the high-pressure and pass-out lines.

It will thus be seen that when the final stage is reached the flow of steam through both ends of the turbine will be dictated by the process steam requirements, the pressure at the pass-out point being maintained sensibly constant—against upward variation by the intake valve of the steam accumulator and against downward variation by the low-pressure inlet pressure control device on the turbine over-riding the back-pressure control.

The change-over from the present to the final conditions will involve the transfer of the speed governor control from the " pass-in " governor valve at the low-pressure end inlet

of the turbine to the high-pressure inlet governor valves. This has been provided for and, with the well-known "Adamson" governing system employing oil pipe connections alone, presents no difficulty.

Two other points are of special interest. The first is that, in order to increase the quantity of steam available for use in the low-pressure end of the turbine, a second outlet has been added to the accumulator carrying an "Arca" valve reducing pressure to 65 lb. per sq. in. so that, when the accumulator pressure is above this level—a condition which it is found in practice can at most times be maintained—process steam at both pressures, *i.e.*, 65 and 30 lb., is drawn from the accumulator. When, due to heavy demands, the pressure in it falls below 65 lb., the higher pressure control valve is automatically cut out by a limit relay and the higher pressure process steam is then supplied direct from the 110 lb. line *via* a reducing valve set to reduce to about 60 lb.

The second point referred to is the means employed for reducing the demand on the public supply during the winter months. At the start and end of the day the works steam demand is very low, building up after and falling away before the electrical demand. To improve the balance between steam and electrical demands an artificial steam load is created during these periods by heating water which is later used for process purposes in the works, the arrangement being thus in effect an additional steam storage facility for steam at the final turbine exhaust pressure.

Public Supply Arrangements

The public supply is received at 3,000 V and is transformed on site to 400 V, at which pressure it is handled by one of two 2,500-A main steel clad circuit-breakers in the turbine house basement. The other main circuit-breaker handles the supply from the works alternator and both are fed to an eleven-panel main switchboard situated in a switch house annexe at the turbine floor level. This board, in common with the main circuit-breakers, is of Crompton-Parkinson make, comprising the well-known "Klad" equipment. Control panels for the main circuit-breakers (remote electrically operated) for both private generation and public supply are situated in the turbine room at the operating-floor level close to the turbine controls and it is from here that the actual synchronising operations are conducted.

From the main switchboard transmission is by p.i.l.c. armoured cables to main distribution boards throughout the mills and from these boards 3-core v.i.r. armoured cables are taken direct to sub-distribution boards, motors and the starting equipments. The particularly neat and accessible lay-outs are evidence of the attention given to the basic idea of designing the installation as a complete scheme. A typical power distribution lay-out point consists of a 400-A circuit-breaker feeding a ten-way 120-A Parmiter, Hope and Sugden distribution board with, of course, cartridge fuses of "Aeroflex" form and carrying a 400-A incoming isolating switch.

A separate switchboard for lighting situated in the switch house annexe is of similar construction to that of the main eleven-panel board. This lighting board can be fed from the works turbo-alternator set *via* a 400-kVA 400-V/200-V 3-phase (115-V phase and neutral) transformer, or from a separate 115-V service for lighting from the public supply. The direct current closing and tripping supplies for the main circuit-breakers are obtained from a 50-V battery of Chloride accumulators with trickle-charging rectifier equipment.

The distribution arrangements for lighting are very similar to those for power, each distribution point comprising a main distribution board with isolating switch of the same type as the power boards but arranged for 4-wire connections. Transmission to these boards is by p.i.l.c. armoured cables and from them to the "splitter" and sub-circuit boards by 4-core and twin v.i.r. armoured cables.

As consulting engineers, Messrs. McLellan and Partners were responsible for the conception, design and installation of the scheme. We are indebted to Ferguson Brothers, Ltd., for permission to visit the mills to collect the above information and to take the accompanying photographs, and to Mr. R. J. Doyle, their chief engineer for his help on the occasion of our visit.

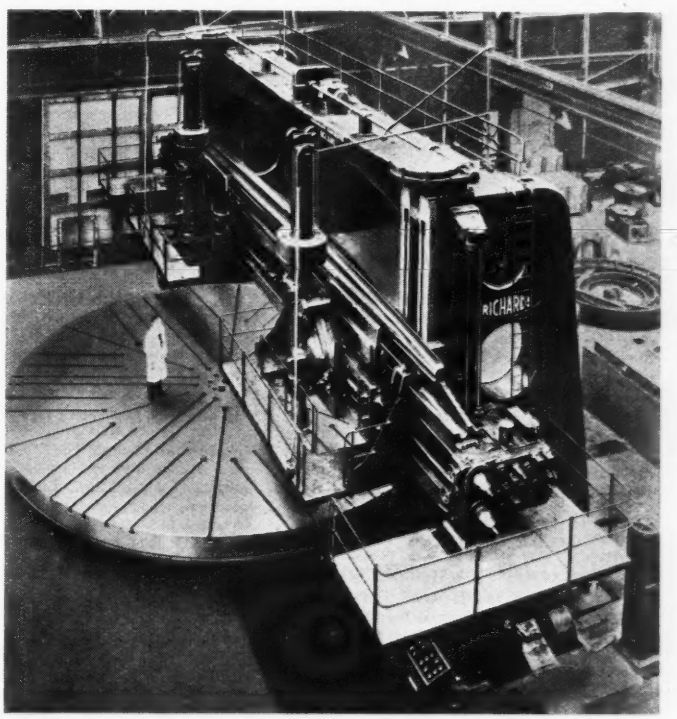
Large Boring Mill

Contactor-type Control

A TYPE of machine tool drive which lends itself particularly well to the use of contactor-type control gear with push-button control is that of a large boring mill. Some recent equipments supplied by the Metropolitan-Vickers Electrical Co., Ltd., have been for use with boring mills of 16 ft., 22 ft. and 35 ft. capacity, built by George Richards, the last mentioned machine being, it is believed, the largest in the country.

In addition to giving full push-button control of all the motions of the machine, including the rotary motion of the table, there is also provision so that the table may be used with a reciprocating motion. Thus, in effect, it becomes a rotary planer, the necessary limit switches, etc., being provided to control the length of the cut.

It can be well appreciated that with machines of this capacity the possibility of being able to locate the whole of the control for the various motions, *viz.* the table, the cross slides, the lifting motors, feeds, etc., at one point, together with the simplicity which is a feature of push-button control, enables the machine operator to devote his major attention to the work being dealt with by the machine.



A 35-ft. capacity boring mill equipped with Metrovick contactor-type control gear

PERSONAL and SOCIAL

Information regarding new appointments and other matters of interest for this page are welcomed

THE Council of the Institution of Electrical Engineers announces that **Sir Andrew Duncan** has been elected an honorary member of the Institution in recognition of his outstanding public services, particularly to the electrical industry. Sir Andrew was, of course, the first chairman of the Central Electricity Board and was thus very largely responsible for the carrying out of the grid scheme. He resigned the position in 1934 but remained a member of the Board. Soon after the outbreak of war

Sir Andrew Duncan

Dr. A. P. M. Fleming

Sir Andrew became President of the Board of Trade and in October last was appointed Minister of Supply.

The Council also announces the award of the nineteenth Faraday Medal to **Dr. A. P. M. Fleming,** who is a past-president of the Institution.

The triennial award of the Coopers Hill War Memorial Prize and Medal, which fell in 1940 to the Institution of Electrical Engineers, has been made by the Council to **Mr. John S. Forrest,** M.A., B.Sc., for his paper on "The Characteristics and Performance in Service of High Voltage Porcelain Insulators."

Mr. E. S. Saunders, O.B.E., M.I.E.E., district officer at Surbiton and area engineer to the London & Home Counties Joint Electricity Authority, has retired on superannuation. For the duration of the war **Mr. C. Keene,** district officer at Weybridge and Esher, is to take over, in addition to his present position, the duties formerly carried out by Mr. Saunders as district officer, Surbiton, and he will receive a temporary addition of £100 to his salary while so employed.

The Times reports that the **Rev. C. J. Grimes,** A.M.I.E.E., rector of Thorpe Malsor, Northants, has been appointed Archdeacon of Northampton and Canon-residentiary of Peterborough Cathedral.

Mr. R. A. C. Baldwin, senior charge engineer with Tunbridge Wells Corporation Electricity Department, has resigned on account of continued ill-health.

The George Medal has been awarded to **Mr. C. D. Lindsey,** electrical foreman, Port of London Authority, who during a raid on a London dock realised the danger to firemen from playing jets of water on the bare high-power electric cables spanning the roofs of the warehouses, some of which were on fire. At great personal danger Mr. Lindsey disconnected the switches on the cable supports and cut off the power from the dangerous sections.

For their gallant conduct when a bomb practically demolished a substation last October, two members of the staff of the Hornsey Electricity Department have been officially commended. They are **Mr. A. S. Craven,** substation engineer, and **Mr. L. H. Luscombe,** assistant mains engineer.

Mr. D. J. Bolton, M.Sc., M.I.E.E., the author of the article on "Working Class Budgets" on page 346 of this issue, is a lecturer and consultant and is on the staff of the Regent Street Polytechnic. He is a member of the Council of the Electrical Research Association and of the London and Home Counties Joint Electricity Authority of whose Local Distribution Committee he is vice-chairman. Mr. Bolton has written a number of papers and books on electricity tariffs and economics and has frequently contributed to our columns.

Mr. L. G. Ashton, A.M.I.E.E., late of the Willesden Corporation Electricity Department, and who now holds an Admiralty appointment, was married at Ealing, recently, to Miss S. G. Robson, who has also been a member of the Electricity Department staff at Willesden.

Miss M. Curtis, senior lady demonstrator at Ilford, has been appointed to a similar position with the Willesden Borough Council.

Mr. W. M. Little, B.Sc., A.M.Inst.C.E. of the Edinburgh Corporation Transport Department, has been appointed general manager and engineer of the Passenger Transport undertaking of St. Helens Corporation, Lancs. Mr. Little, who has been in the administrative office of the Edinburgh Corporation Transport Department, graduated B.Sc. with honours in electrical engineering, at Edinburgh University in 1930. Appointed to the staff of the Transport Department in 1934 as an engineering assistant, he was promoted to the position of maintenance engineer in 1937. He had practical training in various departments as transport engineer, completing a two years course in the workshops of the Edinburgh undertaking after taking his degree, and having also completed a course with the Metropolitan-Vickers Electrical Co., Ltd., Manchester. He is the holder of a British patent for a transport point controller.

Obituary

Mr. C. S. Richards.—The death of Mr. Charles Sydney Richards last week has deprived the electrical industry of a valuable trade ambassador. Mr. Richards was a member of Lord Willingdon's commission to South America and was drowned while bathing at a place on the Brazilian coast. He was joint managing director of the Metropolitan-Vickers Electrical Export Co., Ltd., and a director of the Metropolitan-Vickers Electrical Co., Ltd., and had had considerable personal experience of world electrical markets.

Mr. Richards was educated at Manchester University, where he graduated B.Sc. with first-class honours. He joined the British Westinghouse Co. (the predecessors of the Metropolitan-Vickers Co.) about thirty-eight years ago and specialised in export work, in the course of which he visited many parts of the world.

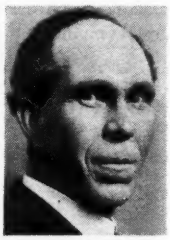
The late Mr. C. S. Richards

For some years he was in charge of Metropolitan-Vickers interests in Russia and his name was mentioned in the course of the trial for "sabotage" of six Metro-Vick employees in Moscow in 1933. It was then alleged that he was in the British Secret Service and directing from England the alleged subversive activities of the defendants. Sir John (now Lord) Simon, the Foreign Secretary, stated in the House of Commons at that time that there was not a grain of truth in the statement.

Mr. Robert W. Willis, M.I.E.E., electrical engineer to the Cheadle and Gatley U.D.C., died at Bramhall a few days ago at the age of fifty-seven. Mr. Willis has been in ill-health for a considerable time, and had decided to retire from the Council's service on January 31st. He joined the Cheadle undertaking upon its commencement, being at that time assistant to the late Mr. C. H. Wordingham, who prepared the scheme and on its completion he was appointed engineer and manager.

Mr. J. Pailin.—We regret to report that Mr. James Pailin, a founder and for many years director of Ferguson, Pailin, Ltd., Manchester, died recently at Bramhall, at the age of sixty-five.

Professor B. P. Haigh.—We report with regret the death, on January 18th, of Dr. Bernard Parker Haigh, Professor of Applied Mechanics at the Royal Naval College, Greenwich. Dr. Haigh was probably best known for the machine bearing his name which he devised for the testing of the fatigue of metals. He was also largely responsible for the method adopted for combating the magnetic mine.



The late Professor B. P. Haigh

After receiving training in Glasgow University, Dr. Haigh was apprenticed to Bruce Peebles & Co. and served in the company's design department under Mr. J. L. la Cour, the inventor of the la Cour rotary convertor, with whom he later spent some time in Germany and Sweden. In 1908 he joined Brown Bros., Edinburgh, and was engaged in steering gear design and in 1910 he was appointed assistant to Professor Archibald Barr at Glasgow University. He went to the Royal Naval College in 1913 as lecturer in applied mechanics and succeeded Sir James B. Henderson as professor in this subject in 1920. During the last war Dr. Haigh rendered valuable service, including work on the paravane for anti-submarine operations. He was fifty-six years of age.

Dr. H. S. Hele-Shaw.—The death occurred on January 30th at the age of eighty-six, of Dr. Henry Selby Hele-Shaw after a very active life spent largely in engineering teaching and research. His name was connected with a large number of inventions in the power-transmission field.

Dr. Hele-Shaw commenced his academic career in 1881, when he became the first professor of engineering in Bristol University. In 1885 he was appointed to the Harrison Chair of Engineering in Liverpool University but resigned in 1904 to go to the Transvaal Technical Institute, where he was at first professor of engineering and later principal and organiser of technical training in the Transvaal. He held doctorates in engineering,

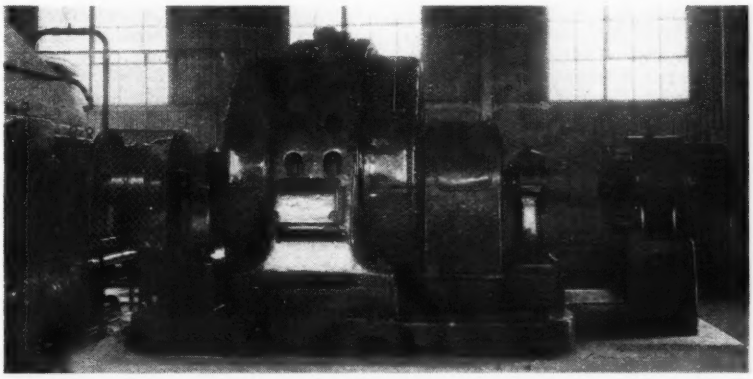
(*Continued on page* 339)

Large Auto-synchronous Motor

Power Factor Improvement in Cement Works

IN a large cement mill power factor improvement became important when a new grinding mill had to be installed. The load, including 600 HP of mill motors, averaged 820 kVA, while the power factor was no better than 0.66 lagging. Consequently it was decided that some of the mill motors should be superseded by a new grinding mill, operating at approximately 19 RPM, to be driven by an 800 HP, 750 RPM Crompton auto-synchronous motor through a gear box manufactured by Turbine Gears, Ltd.

The motor is a two-pedestal bearing machine mounted on a bedplate and is flexibly coupled to the gear box. It is designed to operate at a maximum of 0.9 leading power factor at 3,300-V, 3-phase, 50-cycles and the power factor is adjustable by means of a control pedestal incorporating an exciter shunt field regulator and a moving-coil excitation ammeter.



An 800-HP Crompton auto-synchronous motor in a cement works

Thus, when the grinding mill is run alone the power factor is adjusted to unity and the losses are so reduced that an electrical efficiency approaching 97 per cent. at full load can be realised. At the same time, the overall efficiency of the plant can be raised and the power costs reduced by increasing the excitation and thereby effecting power factor improvement. Under this condition the auto-synchronous motor runs at the unusually high figure of 96.1 per cent. at 0.9 leading power factor at full load.

The Crompton auto-synchronous motor is said to retain the high electrical efficiency of the salient-pole synchronous motor and be also capable of a starting performance equal to that of an induction motor of equivalent output. This performance is obtained by a special arrangement of the secondary windings, which ensures a concentrated field form under running conditions while retaining a distributed effect with a complete iron circuit to produce the induction motor characteristic at starting.

Control is by an Ellison oil switch interlocked and interconnected with an automatic contactor panel manufactured by Contactor Switchgear, Ltd., Wolverhampton. Pressing the "start" push button closes an auxiliary contactor, which in turn sounds an alarm to give warning that the mill is due to be started. But it is not possible to close the "Ellison" switch and thereby start the motor until a period adjustable between 10 and 30 seconds has elapsed, after which an indicator lamp shows that the no-volt, no-close device is ready to function, so that the oil switch can then be closed.

If, for any reason, the switch is not closed during a second period, adjustable between 10 and 30 seconds, the no-volt coil will be interrupted and the "start" push button must be pressed again in order to recommence the sequence. But, upon closing the oil switch the motor and a secondary starting relay on the automatic panel are energised, the relay having the effect of cutting out the secondary resistance step by step and so accelerating the motor up to full speed, synchronisation taking place automatically. The energy for operating the pilot circuits for the various safety features is obtained from a separate low-voltage single-phase supply which can be made available through a separate transformer from the main high-voltage supply. In addition to the normal "stop" push buttons there are further safety features in the form of oil pressure switches and emergency stops which have the effect of opening the circuit-breaker and also the secondary contactors.

Supplementary to the main motor, is a small barring motor which is connected by means of a clutch to the mill for turning the cylinder very slowly for feeding-in purposes and for adjusting its position. By an arrangement of shielding on the "stop" and "start" push buttons it is impossible to operate the main "start" button while the barring motor is running, and *vice versa*.

Obituary (*Continued from page 338*)

science and laws and was elected a Fellow of the Royal Society in 1899. At the time of his death he was professor emeritus of Liverpool University.

Mr. A. J. Makower.—The death occurred on February 1st of Mr. Alfred Jacques Makower, M.A. (Cantab.), M.I.E.E. Mr. Makower, who was born in London in 1876, was educated at the Universities of London and Cambridge (Trinity College) and at the Technische Hochschule, Charlottenburg. He spent two years on testing and research with the Union Elektricitäts Gesellschaft, Berlin, and in 1902 joined the British Thomson-Houston Co., Ltd., Rugby. Two years later he was appointed head of the Electrical Engineering Department of Chelsea Polytechnic and became a member of the Board of Studies and Board of Examiners in electrical engineering in the University of London. He also served a term as chairman of the Electric Vehicle Committee of Great Britain. In 1913 he joined the board of Mossay & Co., Ltd., makers of electric cranes, pneumatic tools, etc., and he remained a director of the company up to the time of his death.

Mr. C. C. Pudney.—The death is announced at the age of sixty-seven, of Mr. Charles Clement Pudney, the founder of the electrical firm of C. C. Pudney & Co. Ltd., of Bury St. Edmunds, with which firm he was associated for over fifty years. Mr. Pudney was also a director of C. C. Pudney, Peirson & Co., Ltd., of Halstead, Essex. He leaves a widow, one son and two daughters.

Mr. J. W. Hay.—The death has occurred at Brighton of Mr. John William Hay, the founder and one of the managing directors of Hay & Son (Brighton), Ltd.

Mr. David Sparvell, J.P., of Belmont, Camberley, whose recent death is announced at the age of ninety-six years, was the founder of the Yorktown (Camberley) and District Gas and Electricity Co., of which he was for many years chairman.

Mrs. J. T. MacGregor-Morris.—We extend our sympathy to Professor J. T. MacGregor-Morris, M.I.E.E., of Queen Mary College, in the loss of his wife, who died at their home at Hampstead on January 29th.

Mr. C. B. Weston.—The death is announced of Mr. Cecil Burton Weston, A.M.I.E.E., aged forty-two, which occurred on January 26th, at Totteridge.

Mr. D. P. Dunne.—We learn with regret of the death on January 31st of Mr. Daniel Patrick Dunne, managing director of the Chloride Electrical Storage Co., Ltd. Mr. Dunne's genial personality, his pleasant intimate delivery and his fund of stories will be greatly missed by all who looked forward to meeting him on "Exide" occasions—particularly the company's annual Motor Show luncheon.

Mr. D. Paxton.—We regret to learn of the death of Mr. David Paxton, M.I.E.E., which occurred in India on September 15th. Mr. Paxton had been for the last eight years general manager in India for Daniel Adamson & Co., Ltd., and he was also connected with the *Indian and Eastern Engineer* as associate technical editor.

Church Wiring

Regulations to Ensure a High Standard

IN the eighth report of the Central Council for the Care of Churches appears a memorandum for the guidance of parochial authorities about to install new lighting apparatus and a series of regulations to be observed by contractors. These have now been reprinted and are obtainable from the Press and Publications Board of the Church Assembly at 2d. net. The memorandum summarises the principles to be observed and stipulates that the contractor engaged must be on the National Register of Electrical Installation Contractors. Attention is drawn to the need for visual inspection of the whole installation every five years and for keeping records of insulation testing.

Prefacing the regulations for contractors is a statement that the work must comply with the Regulations of the Institution of Electrical Engineers, of the local supply undertaking and of the appropriate insurance company. Cables should be v.i.r. or paper-insulated and must be run in heavy-gauge solid-drawn galvanised welded screwed conduit (preferably) or in heavy-gauge welded screwed conduit to B.S.S. No. 31, Class B. Alternatively " Pyrotenax " may be employed. Attention is drawn to a modification of an electric soldering iron for heating sealing compound which enables joints to be made on the spot instead of entailing removal to a bench for heating with a blow lamp, in order to avoid risk of fire where timber is adjacent.

The need for guarding against fire risk and for preserving the architectural features of churches has led to the introduction of comprehensive rules which contractors (who must be registered) are required to observe

The use of lead-covered cable is not generally permissible. If allowed, saddles should be not more than 18 in. apart. Metal boxes and earth continuity must be provided for all boxes; wire staples may not be used. Where walls are liable to damp, conduits should be kept at least ⅜-in. clear of the surface by special spacing saddles (the same applies to enamelled steel conduit). Lead-covered cables where liable to damage should be protected by light steel coverings. Where concealed or in contact with oak they must be run in earthed screwed conduits. L.c. cables must contain an earth wire and all junction fittings must be compound filled.

No cables may be used of less than 3/.029 and, except in the case of " Pyrotenax," they must be stranded. For wiring in conduit, 250-V C.M.A. Class No. 4101 and, for l.c. and flexible cables, 600-megohm C.M.A. grade are required. In damp situations or where liable to mechanical damage flexible cables should be hard-rubber covered. Silk-braided flex should be used only for very short runs to desk lamps; flex to pendants should be rubber-covered. Every type of cable must be of C.M.A. grade; the use of the " Nonazo " grade is prohibited.

No final sub-circuit must carry more than 600 W when all lights are on. Adjacent lights should be connected to alternate circuits with an average of not more than five main lights on one circuit. Lamps at a high level and those of heavy wattage should be separated by at least 6-in. of space, or by other means, from timber or inflammable material; in the latter case the cable should also be asbestos-sheathed.

Incoming Supply Arrangements

Cables of the supply undertaking should be taken into the building for as short a distance as possible and run only on brick or stone walls and must be adequately protected if within reach. Approved main switch and fuses in cast-iron case, drilled and tapped for conduits, must be fitted near the undertaking's meter. Distribution boxes with fuses must be in cast-iron cases drilled and tapped for conduits (or bushed for l.c. cables). A framed schedule at each box must show the lights controlled by each pair of fuses with a warning against the use of larger or unsuitable fuse wires. This should also be done at each group of switches. Instrument panels should be well clear of walls and should be of slate or other non-inflammable material; if of wood only teak may be used, and any casing or doors should be of mahogany or teak.

Supply cables should, where practicable, be underground in the churchyard; any overhead cables should be fixed to a bracket, possibly secured to the roof wall plate, and the insulated cable can be carried over the wall plate and under the eaves so that the wall need not be drilled. Overhead cables must never be attached to pinnacles or near the apex of a gable or enter the church through the glass or stonework of a window.

Exposed metal from which the coating has been removed must be painted as the work proceeds. Unprotected metal liable to rust should not be used and all screws must be of brass. All plugging of walls should be done with " Rawlplugs " or by other approved means. For soft walls or wide joints, dry hardwood tapered blocks may be needed, secured by cement to within ¼-in. of the wall face and finished with Parian to match surroundings. For exterior work lead plugs must be employed. Conduits and fittings on the surface should be painted after erection to match the groundwork. For this purpose " Silverlac " and not black enamelled conduit should be used. Failing a water system, a copper plate or tube or galvanised pipe can be driven into the ground to not less than 6 ft.

Holes may not be made in buttresses, piers, mullions, columns, detached shafts, vaulting ribs or bossing ribs (whether of wood or stone) and fittings may not be fixed to the last named. Beams, structural timbers or mouldings are not to be notched or sawn on any surface and may be drilled only through the neutral axis; the hole will normally not exceed 1 in. in diameter drilled horizontally through the centre of the side of a beam. No beam is to be drilled if smaller than 10 by 10 in. in cross section. Wiring must not be laid over the surface of any carving or painting nor, if any other line is available, over the face of mouldings. It should not be taken down the central points of arches.

The wiring of ancient brass candelabra is condemned, as it would be almost impossible to remove the detachable brasses for cleaning as was almost always the original intention. Wiring must not be inserted into the tubes of old gas fittings. In the open air or in porches fittings of copper, bronze or rustless steel are preferable to avoid corrosion.

Wooden mounting blocks or boards must be of teak, preferably plain oil-finished. Electroliers or fittings must be hung on chains and their weight must not be borne by electric cables or flexible cords; an exception may be made in the case of " Pyrotenax." All reachable metal work is to be earthed. All plugs must be of the three-pin type. Those for heating, of from 10 to 15A, are to be of the interlocking double-pole switch type, the metal sockets being rendered dead when the plughead is withdrawn.

Any relay or other circuit carried to a switch at the organ keyboard for starting the blower must be run in screwed conduit or be of " Pyrotenax "; the starting switch must be in a metal case mechanically and electrically continuous with the circuit and with an approved earth connection.

Anodic Polishing of Nickel

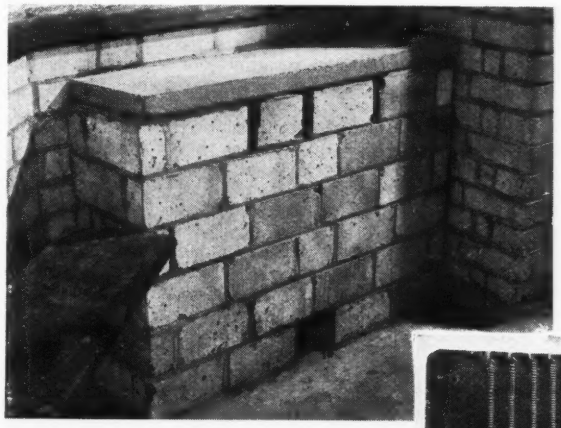
AFTERNOON meetings are to be held at about two-monthly intervals by the Electrodepositors' Technical Society (associated with the Faraday Society) at the Northampton Polytechnic, St. John Street, Clerkenwell, London, E.C.1.

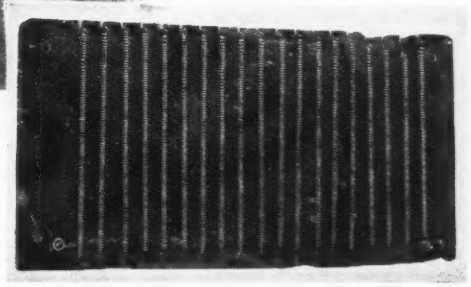
In the paper which was discussed on January 27th, Messrs. A. W. Hothersall and R. A. F. Hammond described how dull deposits of nickel may be given a brilliant finish by brief anodic treatment in a sulphuric acid solution, a polishing action being obtained over a wide range of conditions. The method has possibilities as an alternative to bright nickel plating and it has been investigated from this point of view. Under suitable conditions, it is claimed, the process does not adversely effect the protective properties of the deposit and the quality of the finish is said to be at least as good as that obtainable by bright nickel plating. The method also enables designs to be formed on nickel surfaces by localising the area polished, so that attractive finishes may be produced in this way.

Shelter Heating

Two Quickly-Installed Systems Adopted at Hampstead

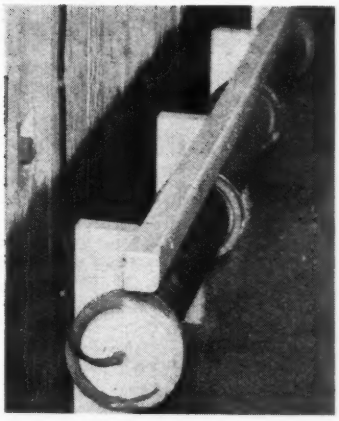
MANY local authorities are having their public shelter heating schemes, electrical or otherwise, held up by the difficulty of obtaining essential parts of the equipment. Two ingenious devices evolved at short notice by Mr. H. Brierley, the borough electrical engineer of Hampstead, not only utilise materials that are readily obtainable almost anywhere—and without priority certificates, too, but cost practically nothing and can be produced and installed in a very short space of time. Actually at Hampstead fifty installations have been carried out within a fortnight of Mr. Brierley's being requested to devise the apparatus, while the cost for the heaters themselves works out at the almost unbelievably low figure of between 3s. and 5s., according to the size and shape of the shelter. The effectiveness of the arrangements leaves no doubt that the remaining fifty or so shelters in the borough will be similarly equipped in the very near future.





The roofing tile heater which is being used with great success at Hampstead. The heater itself (right) is enclosed in the brickwork above

For the type of heater employed in most of the shelters the only materials required are an ordinary roofing slate, a pound of 20 SWG galvanised iron wire, and a couple of nuts and bolts. The wire is wound into a coil on a $\frac{5}{16}$-in. mandrel and the coil then wrapped round and round the slate, the ends of the wire being attached to the nuts and bolts at the bottom. The heater thus formed has a loading of approximately 1 kW and accordingly operates at a safe black heat.



A heater made from ordinary earthenware drain-pipes

Two (or three, in the case of awkwardly or irregularly shaped shelters) of these heaters are suspended in each 50-person shelter by means of two holes in the top corners of the slates, in a 3-in. brickwork casing 3 ft. wide, 30 in. high and 1 ft. deep, with a 2-in. concrete slab on the top. An air inlet is provided at the bottom, with three outlets at the top. In the most exposed positions the brickwork is built out 2 in. from the wall. Time switches are used to put the heaters on three hours before the shelters are likely to be used and they are switched off between 6 and 6.30 p.m., to avoid the peak period, and finally at midnight, the temperature thereafter being maintained without further heating. Besides retaining the heat for a considerable time, the brickwork effectively prevents tampering with the heaters.

Certain of the shelters in the borough are as much as 60 ft. long with a bare 15 in. between the bunks and the wall. Obviously the type of heater already referred to would be unsuitable. In this case galvanised iron wire is again used, but this time wound on a $1\frac{1}{4}$-in. mandrel and housed in a 30-ft. continuous run of ordinary glazed earthenware drain-pipes, 2 lb. of 18 SWG wire being sufficient for the whole length to give a loading of 2 kW. The pipes are raised slightly from the ground, being attached to a wooden cleat by means of clips made from pieces of scrap sheathing of armoured cable. A wooden rail above the pipes both protects them and provides a step for users of the top bunks.

Telephone Cables and Bombs

IN a recent issue we commented upon a broadcast by Col. A. S. Angwin (Engineer-in-Chief, G.P.O.) describing some of the difficulties and hazards incurred in repairing telephone cables damaged through enemy action. We subsequently received particulars of a typical case in which a heavy high-explosive bomb penetrated a road surface, destroying an underground tunnel and severing two telephone cables. Shafts could not be driven from the road surface to connect the broken ends of the cables outside the tunnel because, apart from the time it would take, other urgent repair work in the crater above would have been obstructed. The Post Office engineers decided, therefore, to bore horizontally throught the clay, employing a thrust-boring method in which a hand-operated hydraulic ram forces a strong steel rod through the ground to the far end where a steel tube is fastened to it and pulled back by the ram. This was successfully done in the face of conditions that were far from favourable, as a sharp corner in the tunnel had to be negotiated and, the crater being full of debris, there was no way of anchoring the ram.

At the far end of the tunnel was a slight down-hill slope, where sewage and rain water percolated through the bomb crater and, in spite of fire brigade pumps, began to fill the tunnel. The steel tube while being pulled back parted company with the boring rod about half way. The engineers decided to burrow through the clay to reach the pipe, despite the dangers of clay falling in on them, percolating water, steadily worsening ventilation and even collapse of the tunnel itself. They could not, however, reach the tube because of the obstruction that it had fouled. They then pushed sweep rods through the steel tube and on through the wet clay to the far side. A hundred-pair cable was handed through by hard physical effort and jointed, although by now the water was two feet deep.

For dealing with a second cable containing 254 pairs, the clay at the top of the tunnel appeared to offer less obstruction, but as a thrust borer could be used only at floor level, steel piping was driven through with sledge hammers and the cable drawn through this. By the time the jointing and plumbing (which would have to withstand total immersion) had been completed, at the second attempt, the air had become very foul and the sewage and water was seven feet deep so that the men had difficulty in escaping from the tunnel.

INSTITUTION PROCEEDINGS

Engineering Radiography.

X-Rays in Engineering

MANY points of interest in connection with the growing use of X-rays in engineering were brought out at a meeting of the Institute of Physics held on Jan. 25th in the library of the General Electric Co.'s Research Laboratories at Wembley. The subject was considered from three standpoints, the first of which was the general radiography of specimens occurring in the electrical industry ; the examination, both visually and by photography, of light alloy castings was then dealt with, and finally the character and control of the materials used in radiography.

The remarkable definition obtainable with the aid of lead filters and lead intensifying screens (the latter thin sheets of metal about 0.1 mm. thick laid in contact with the sensitive film during exposure) was demonstrated by some excellent radiographs of transmitting and other radio valves, heating elements and so on, which were shown by Mr. H. P. Rooksby and Miss K. L. Jackman of the G. E. C. Laboratories. In some cases of large specimens, the radiograph had been built up of as many as five separate exposures ; a picture of a valve 4 ft. in height was shown as an illustration of this technique.

It was revealed that while the average industrial equipment used an X-ray tube working at 150 to 200 kV, tubes have now been designed for special technique which can be run at 1,000 kV and over. Great improvement has been effected in the clarity of the negatives by filtering out the softer rays with thin metal sheets, the chief metals employed in these " windows " being copper, molybdenum and lead.

Among other objects diagnosed by X-ray photography were the glass envelopes of cathode tubes, the cores of arc lamp carbons, and the electrode systems of valves and their behaviour under operating conditions.

A second paper, by Mr. W. L. Harper, dealt with many aspects of the X-ray examination of light alloy specimens, more especially in connection with the large scale inspection of aeroplane parts, etc. As Dr. Pullin pointed out, while fine service is being rendered by such inspection, the real place for radiographic or radioscopic equipment is in the foundry, where it must eventually be. When using the gamma radiation from radium as a substitute for X-rays, Dr. Pullin drew attention to the possibilities of radon, a small tube of which would function as a very fine focus tube anode and could be conveniently inserted within a casting, the photographic film being then placed on the outside during exposure.

The work done on the purely photographic side, as discussed by Dr. L. Mullins of the Kodak Research Laboratories, was a welcome contribution to the subject.

One gathered from the discussion that about two inches of steel was the maximum through which radiographs could be secured showing internal flaws, unless tubes working at considerably more than 200 kVp were employed, The use of radium, with its great penetrating powers on an increasing scale in metallography was foreshadowed.

The meeting dealt entirely with the photography or visual inspection of objects with X-rays, or photography with radium, and did not touch the newer field of testing and investigation by means of diffraction patterns. A section of the Institute of Physics is, however, to be formed shortly which will embrace X-ray problems of various kinds.

Alexander Bain

IN connection with the Alexander Bain centenary, a lecture on "Alexander Bain as an Electrical Pioneer" was given to the Edinburgh Electrical Society on January 22nd by Mr. Donald S. Munro, M.I.E.E., who said that Bain's invention of the electro-chemical recorder was in some ways as remarkable and important as Bell's much later invention of the telephone. Bain's patent records were full of ideas which later became commonplaces of progress.

By erecting a telegraph line between Edinburgh and Glasgow he was possibly the first Scottish electrical contractor, and he described methods of cable laying subsequently adopted for power and lighting. Within the comparatively short period of his working life, telegraphs progressed from nothing to a business so well developed that it was taken over by the state. Over £40,000,000 was invested in British telegraph companies some years before Bain died.

Lloyd's Register Activities

Ship Propulsion and Welding

PROGRESS in marine engineering as influenced by the classification of ships is the subject of the thirteenth Thomas Lowe Gray Memorial Lecture, which has this year been prepared for the INSTITUTION OF MECHANICAL ENGINEERS by Dr. S. F. Dorey, chief engineer surveyor to Lloyd's Register of Shipping.

Commencing with a definition of classification, the author goes on to indicate the probable origin of the Society and then describe its constitution and the growth of its register, tracing historically the development of marine propelling machinery, steam boilers and the use of oil fuel.

Brief reference is made to early electric lighting installations in ships and to the rapidly increasing use of electricity for a growing variety of marine purposes, including the driving of auxiliary machinery and propulsion plant.

A considerable number of electrically propelled vessels have been classed since 1915, including five passenger liners of over 20,000 tons each ; and in 1934 the first published rules for electric propelling machinery, embodying all the necessary requirements for classification, were issued by the Society. Details of vessels with electric drive appearing in the Society's Register Book and the dates named are tabulated below.

Vessels with Electric Drive

Register book, date	Turbo-electric		Diesel-electric		Total	
	No. of vessels	Gross tons	No. of vessels	Gross tons	No. of vessels	Gross tons
1925–6	21	84,562	15	25,742	36	110,304
1927–8	22	85,384	26	51,516	48	136,900
1929–30	24	171,150	36	88,317	60	259,467
1931–2	38	342,400	46	114,690	84	457,090
1933–4	43	448,434	48	117,184	91	565,618
1935–6	42	480,236	57	121,261	99	601,497
1937–8	42	483,150	62	129,237	104	612,387
1939–40	44	495,689	74	189,821	118	685,510

Turning to rules for classifying electrically welded ships, Dr. Dorey considers it necessary to emphasise that the welding of high-class vessels, such as boiler drums and shells, is a specialised branch of the welding industry and is of such importance that, so far as Lloyd's Register of Shipping is concerned, this class of work can be accepted only provided the vessels are made by approved firms who have carried out a comprehensive series of tests to demonstrate the consistency and quality of their work.

There are now several oil tankers, built in the U.S.A. and classed with Lloyd's Register, fitted with water-tube boilers having fusion-welded drums, and working at steam pressures of 400-625 lb. per sq. in. and 750-835 deg. F. superheat temperatures, while new liners recently completed in that country are fitted with water-tube boilers each having three welded drums, the working pressure being 500 lb. per sq. in. and super-heat temperature 750 deg. F. The first passenger liner in this country to be fitted with boilers having fusion-welded drums was completed on the Tyne about a year ago.

It can be claimed that, without welding, some of the latest advances in steam generating plant could never have been made. As examples of this, mention might be made of the Loeffler and Sulzer high-pressure boilers, and the Velox steam generator, the main components of which involve a considerable amount of welding.

The Society has been closely associated with important developments and progress made in recent years in the adoption of welding as a substitute for casting in the framework of main propelling and auxiliary machinery.

Commutation Troubles

How they can be Diagnosed and Cured

By "Rotor"

Commutators are prone to various faults which are not always easy to track down. "Rotor" here explains their cause and how to remedy them

THE commutators of some DC machines are apt to become burnt or blackened rapidly. Sparking, which may not be visible, will damage commutator and brushes, and excessive heating or high current density, which causes disintegration of the material at the brush face, is usually the cause of black commutators. The average current density per brush can easily be calculated by dividing the total load current of the machine by half the total number of brushes. The actual density at points on a brush may, however, be many times greater than the calculated value, and local overheating may occur, due to one or more of the following causes :—

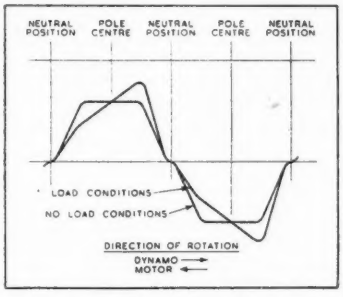


Fig. 1. Effective magnetic flux of non-interpole machine with brushes in neutral position

1. The brushes may not be bedded so that the full area of the face of each is in contact with the commutator. When bedding, a piece of carborundum cloth should be placed under the brushes and moved backwards and forwards with a fairly heavy pressure upon the brushes. In the final stages of bedding the cloth should be used against the brush face only while moving the cloth in the direction of rotation, care being taken that the cloth is held against the commutator so that it conforms to the curvature.

2. Projecting inter-segment micas prevent proper contact between the commutator and brushes and increase the contact resistance, causing sparking or local overload of parts of the brush face. To avoid this the micas are usually recessed below the commutator surface by an amount equal to their thickness. Where the machine works in an oily vapour, however, it is often best to recess the micas less deeply to avoid the risk of carbon dust or dirt sticking in the recesses and causing short circuits, or else to leave the micas flush and use a grade of brush sufficiently abrasive to keep down the micas. If necessary for good commutation a small percentage only of the total brushes could be of an abrasive character, or compound brushes with a centre slice of abrasive material could be used.

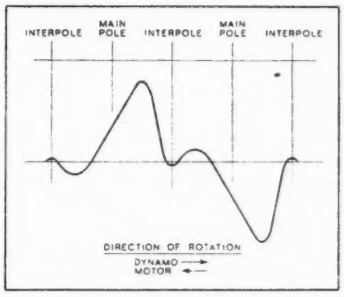


Fig. 2. Effective magnetic flux of interpole machine on load

3. If the commutator is not smooth and true, the brushes may not be able to maintain intimate contact with the commutator, especially if they are heavy or stick in their holders due to carbon dust or dirt or due to their expansion when hot. Grooving of the commutator can be minimised by arranging for the armature to float slightly, and the brushes should be staggered across the full width of the commutator so that both positive and negative brushes cover the same tracks. Should armature float develop after a commutator has become grooved the current density at the brushes will be increased enormously. Vibration may have a similar effect, or chattering of brushes may be caused by insufficient pressure or by the brushes not making a suitable angle with the commutator.

4. Dust may be drawn between the brushes and commutator, especially on high-speed machines, causing increased contact resistance and heating. Brushes with a high percentage of graphite seem less liable to this trouble. Corrosion of the commutator surface may occur due to the action of gases present in the atmosphere. The remedy is to clean the commutator carefully and fit slightly abrasive brushes.

5. Too low brush pressure increases the voltage drop between brushes and commutator, while excessive pressure increases the friction and may allow increased circulating current to pass during commutation, owing to reduced contact resistance. Unequal brush pressure results in the brushes having the heaviest pressure carrying more than their share of the load current. In a machine having many brushes in parallel this defect may cause one or more brushes to get red hot or the pigtail connections to burn, especially at starting up. With heavy brushes due regard should be paid to the weight of the brushes on the bottom sets and a small spring balance can be employed for testing brush pressures.

6. A brush of too low a contact drop or specific resistance may allow excessive circulating currents and thus increase the brush loading. On the other hand brushes of too high a contact drop or specific resistance result in increased I^2R losses. Brushes of different grades should not be indiscriminately mixed on a machine or unequal brush loading may result. Brush manufacturers will usually advise a suitable grade on receipt of full details.

The Process of Commutation

The problem of commutation is to collect the load current and at the same time to change the direction of current flow through the armature coils. Due to the inductance of the coils the current cannot instantly be reversed and, in consequence, a current will pass through the coils short-circuited by the brushes during commutation. The value of this short-circuit current depends on the voltage induced in the coils whilst short-circuited, this being governed by the strength of magnetic field acting on the coils, the speed and number of turns in the coils, and also upon the inductance and resistance of the circuit comprising armature coils, brush contact, and brush resistance. Fig. 1 indicates the shape of field form likely with a non-interpole machine and illustrates the effect of armature reaction in distorting the main field, while fig. 2 shows the field form of a machine with interpoles.

With straight-line commutation the nominal current density would be the same over the whole area of brush face and no current would pass through a short-circuited coil while lying on the axis of the brushes. Under-commutation causes the current density to be increased at the edge where the commutator leaves the brush; over-commutation causes increase of current density at the opposite edge of the brush.

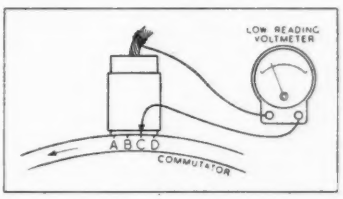


Fig. 3. Method of testing contact voltage drop

Unequal spacing of brush sets upsets the commutation. This can be checked by marking the position of adjacent sets of brushes on the commutator and turning it in the direction of rotation to check the next brush sets with the marks, and so on. Strength and spacing of field poles also has a big effect on commutation. Field strength may be incorrect due to winding faults, blow holes in castings, or worn bearings allowing a reduced air gap

under certain poles. The interpoles must have the same polarity as the next main poles in the direction of rotation for a dynamo and the opposite polarity for a motor.

The state of commutation can be tested by measuring the voltage drop between the brushes and commutator while the machine works on load. A low-reading voltmeter giving a good reading up to about 2 V is connected between a brush pigtail and three or four points on the commutator in line with each brush as at A B C and D in fig. 3. A small wooden or fibre block can be rigged up to hold a carbon rod in each of the desired positions on the commutator: the block can then be fitted in a brush holder and the tests carried out with the commutator in good condition and brushes well bedded.

With straight line commutation the voltage drop at each point will be the same, but with under-commutation the voltage at D will be less than at A. The reverse conditions apply with over-commutation and in extreme cases the voltage drop at one edge may be reversed. Under-commutation of an interpole dynamo is due to the interpoles being too weak or the brushes being away from the neutral position, while in the case of a non-interpole dynamo it is due to the brushes not being far enough advanced for the load (retarded in the case of a motor). Over-commutation is due to the reverse conditions.

To remedy these faults the brush position should be made correct. If necessary, interpoles are strengthened by rewinding or by inserting soft iron strips under them to reduce the air gap. Interpoles which are too strong could have some of the current diverted by a metal strip connected across the coils, this being reduced in width by filing to give a final adjustment. Interpole strength may be affected by wear of bearings causing reduced air gap and increased strength on some poles and the opposite conditions on other poles.

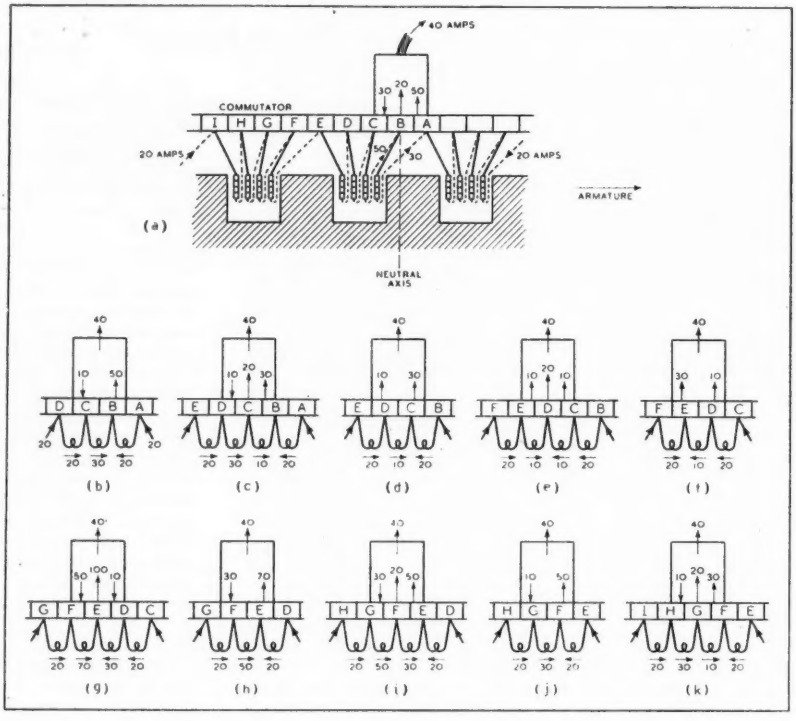


Fig. 4. Current in coils, commutator and brushes during commutation

Blackening of Equidistant Segments

A fault sometimes experienced on DC machines is that of blackening of equidistant commutator segments. This, again, is due to excessive current density as indicated in the following example, which relates to a machine having brushes of, say, 1 sq. in. cross section, with a normal current density of 40 A per brush. While the commutator segments of a machine are equally spaced, if the armature has more than one coil per slot these coils will not be equally spaced. The figures refer to an armature with four coils per slot and the calculations assume that the field strength and resistance of the short-circuited armature coils, commutator, brush contact, and brushes is such that a circulating current of 40 A will flow through a short-circuited coil situated at a distance equal to one commutator segment displacement from the neutral.

Assuming the field form near the neutral is such that its strength is proportional to the distance from neutral, fig. 4a indicates that the coil short-circuited through segments A and B is displaced three-quarters of a segment back from neutral and will, therefore, carry a circulating current of 30 A, neglecting coil inductance. This back displacement of coils is similar to the average position of coils with under-commutation due to a weak commutating field. The current in the coils short-circuited through segments B and C will be 50 A.

The nominal current density of 40 A per sq. in. of brush is composed of 200 A per sq. in. $\left(\frac{50}{\frac{1}{4}}\right)$ in the quarter of the brush where the commutator leaves, 40 A per sq. in. in the centre half $\left(\frac{20}{\frac{1}{2}}\right)$, and 120 A per sq. in. $\left(\frac{30}{\frac{1}{4}}\right)$ in the quarter of the brush where the commutator enters. The brush contact drop is largely independent of the current density unless this is very abnormal, when increased voltage drop causes more current to be shunted from a heavily loaded segment through a short-circuited coil to a lighter loaded segment.

Following the armature as it moves round, the commutator positions are shown for half a segment advance and the average current density per segment for the positions shown is 28 A for segment C, 16 A for D, 64 A for E, and 52 A for F; whilst the maximum density for the positions shown is 60 A for segment C, 20 A for D, 100 A for E, and 100 A for F. The effect may be to cause two clean segments to appear alternately with two black segments around the commutator.

This is an inherent defect with slotted armatures having more than one coil per slot, but normally the design of a machine is such that the commutator is not visibly affected. The defect is intensified by a magnetic field having considerable variation of strength near the neutral position, by incorrect brush position, imperfect bedding of brushes or by the use of brushes of too low resistance or contact drop. Provided the brushes are in correct position and properly bedded, brushes having increased resistance or contact drop may cure this trouble, since the circulating current has to pass through the brush material once, and twice between the commutator and brushes, each time a coil is short-circuited.

Assuming the nominal current density is not thereby made excessive, a more uniform field acting on the short-circuited coils can often be obtained by reducing the width of the brushes, and this method may be tried if attention to brush position and bedding and the use of a different grade of brush fails to effect a cure. In an extreme case the shape of the main poles or the shape or strength of interpoles may need slight alteration to change the field form, but alteration of pole shape is not advisable without reference to the designers of the machine. Commutation faults tend to be cumulative, since damage to the commutator surface results in imperfect brush contact and further increase of current density.

Wholesalers and the E.I.B.A.

DESPITE the difficulties under which electrical wholesalers are now carrying on they are not unmindful of the needs of the Electrical Industries Benevolent Association, and we are glad to learn that the Electrical Wholesalers' Federation has sent to the E.I.B.A. its annual £500, the major part of which is derived from a collection among members.

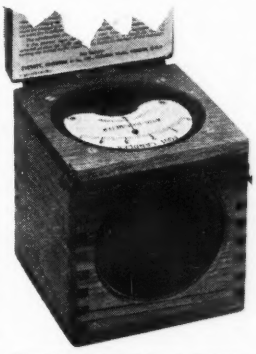
NEW ELECTRICAL PRODUCTS

A Review of Equipment Recently Marketed

Special-Purpose Photometer

RECENTLY issued wartime lighting restrictions (lights carried by road vehicles) specify an upper limit for motor car headlamps of 2.5 ft.-candles, measured at a distance of 10 ft. "from the headlamp." To be able to check the requirement the Ministry of Home Security approached EVERETT, EDGCUMBE & Co., LTD., Colindale Works, Hendon, London, N.W.9, with a view to the development of a simple direct-reading photometer for the purpose.

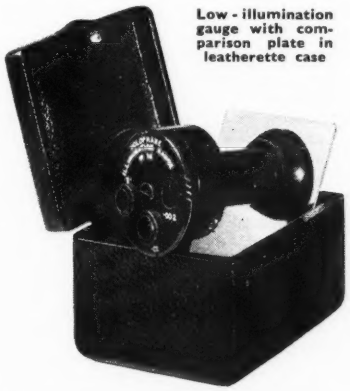
The resulting instrument incorporates alight-sensitive "autophotic" cell, which forms the light-receiving surface, mounted on one side of a strong teak box measuring only 3 in. each way. On the top of the box, protected by a flap lid, is the moving-coil indicator, scaled to read directly from 0 to 5-ft. candles. To use the meter it is only necessary to hold the sensitive surface vertically in the beam of light at a distance of 10 ft. from the lamp of a vehicle, and read off the degree of illumination indicated on the calibrated scale. It is understood that practically all police authorities throughout the country have been provided with one or more of these instruments.



Simple direct-reading motor-car headlamp photometer

Low-Illumination Gauge

A comparator type of low-intensity illumination gauge has been made up in accordance with the draft revision of BS/ARP.30 for values of (*a*) 0.2 and 0.02 and 0.002 ft.-candle, and (*b*) 0.1 and 0.001 ft.-candle. It is supplied by HOLOPHANE, LTD., Elverton Street, Westminster, London, S.W.1, in a small leatherette case, the gauge being 1⅞ in. in diameter by 3¼ in. long when closed. The source of comparison is a radium-luminous compound, a matt white opal test plate being placed at the position where the illumination is to be gauged.



Low-illumination gauge with comparison plate in leatherette case

Through a lens of 7 mm. aperture, with an eyepiece fixed in a telescopic tube, is seen a white diffusing disc with a small central circular opening, which disc is illuminated by an annulus of radium-luminous compound of a suitable brightness. Beyond the disc and in the optical train is fitted a greenish filter mounted in a cell, which has the effect of matching the colour of the illumination under test with that produced by the radium-light source.

With instrument (*a*) the intensity of the light emitted by the radium is so calibrated that an illumination of 0.002 ft.-candle is obtained; with instrument (*b*) the intensity emitted is such that 0.001 ft.-candle is obtained, in both cases without the interposition of reducing filters in the front aperture.

Fitted to the front of the instrument is a circular metal disc fixed eccentrically with reference to the central axis. This disc is arranged with two neutral filter cells, a clear aperture and a blank area 90 deg. one with the other, and is rotatable round its centre so that either of the positions can be brought into the path of light as required. Each position is definitely located by a spring ball catch.

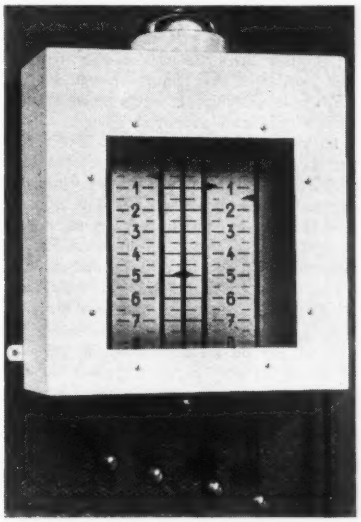
The neutral filters reduce the incoming light by $\frac{1}{10}$ and $\frac{1}{100}$ giving the values 0.02 and 0.2 ft.-candle respectively for instrument (*a*) and 0.01 and 0.1 ft.-candle respectively for instrument (*b*). When not in use, the blank portion of the rotating disc should cover the field of view so as to keep the radium compound stable. When checking very low values of illumination the observer's eyes should be properly "dark-adapted."

Photographic Dark Room Timer

The range of electrical dark room accessories for X-ray work offered by the "Metalix" division of PHILIPS LAMPS, LTD., Century House, Shaftesbury Avenue, London, W.C.2, is equally suitable for commercial photographers' purposes. A recent addition thereto is an electrical timer combined with a "safelight" which enables four films, or plates, to be developed simultaneously without confusion. The pre-setting of the processing time may be varied to compensate for deterioration of the developer, or to counteract temperature changes, so prolonging the effective life of the solution and reducing the likelihood of film wastage.

Once set, the device functions automatically, being driven by a small motor that revolves noiselessly in synchronism with the AC mains frequency. Four vertical timing scales inside the box-like case are clearly visible through a photographically safe light screen. They are graduated from zero to eight minutes and a travelling pointer on each scale moves upward as development proceeds. The centre scale with a double pointer is the master control with which to preset a standard developing period for all four timing units.

When development of each film, or batch, begins, the pendant knobs are pulled down by hand in succession until their associated pointers stop opposite the pre-fixed time figure, selected by rotation of the central master knob. As development proceeds the pointers mount the scales and ring a bell when zero is reached to warn the operator that development has been completed. Two tubular lamps, one on each side behind the cover, illuminate the yellow-green window so that only reflected light is seen. The white enamelled case has lugs for fixing to the wall.

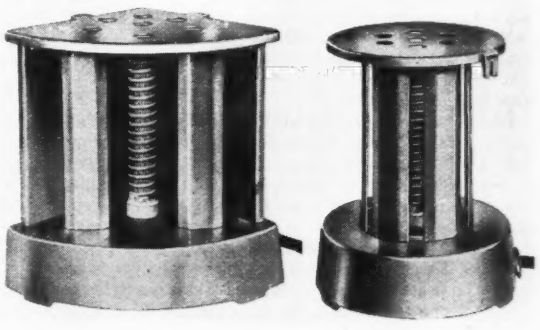


Developing timer for photographic dark rooms

Shelter Heaters

Two freshly produced heaters announced by the JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, London, S.W.1, have been specially designed as air-raid shelter heaters, but will serve equally well for use in lofts of ordinary houses, or to protect water pipes against frost in severe weather. One model is circular and the other is shaped to fit snugly into a corner, lugs being provided for fixing to the wall.

The heaters are strongly constructed of cast iron and sheet metal, finished in art silver, and fitted with a 0.6 kW spiral element in each case. They are compactly made and quite safe when properly installed, the dimensions of the smaller model, which weighs 5 lb., being 8.25 in. in height by 6.5 in. in width and depth.



Corner-fitting and round Jackson shelter heaters

Working-Class Budgets

Electrical Expenditure and Possibilities

By D. J. Bolton, M.Sc., M.I.E.E.

THE cost-of-living index, by which so many wage rates are adjusted, was instituted in 1914, but the proportions allocated to the different classes of expenditure are based on figures obtained some ten years earlier. There have been many complaints from time to time that these proportions are no longer representative, and that the index based thereon is correspondingly unsatisfactory. It was partly as a result of these criticisms that the Ministry of Labour conducted in 1937–38 an inquiry into the expenditures of working-class households. The results of this inquiry have just been published, and they throw an interesting light on the domestic electrical market both actual and potential.

In all, nearly eleven thousand households submitted budgets for the four sample weeks (October, 1937, and January, April and July, 1938). They refer to insured manual workers, non-manual workers below £250 a year, and agricultural labourers, and they were distributed throughout the United Kingdom in approximately the same proportions as the totals of insured persons. The details now published by the Ministry of Labour* refer, however, only to the industrial households, covering 8,905 complete sets of effective budgets.

The author examines the results of the recent Ministry of Labour cost-of-living inquiry in an endeavour to discover the extent of the scope for further domestic electrification

It appears that the "average" industrial household consists of 3¾ persons, of whom 2½ are 18 or over, and one is a child under 14. The average number of wage earners in the household is 1¾, and the total wage is 86s. 3d. per week. The proportions in which this wage is expended are shown in the following table, together with the corresponding figures for the earlier inquiry.

	1904	1937	
	Per cent.	Per cent.	Amount per week s. d.
Food	60	39½	34 1
Rent and Rates	16	12½	10 10
Clothing	12	11	9 4
Fuel and Light	8	7½	6 5
Miscellaneous	4	29½	25 7
Total			86 3

The outstanding changes have been a fall in the expenditure on food from 60 to 40 per cent. and a rise in the miscellaneous item from 4 to nearly 30 per cent. The fuel and light proportion remains unchanged and is rather more than half that spent on rent. The change in the food expenditure is doubtless related to the decrease in the number of children per household, and to the (pre-war) drop in food prices. The miscellaneous item is analysed below.

Looked at from the electricity supply aspect it is evident that an increase in the revenue from working-class households can only come in one or other of two ways—either there must be a change-over from other forms of lighting and heating or there must be a greater total expenditure on these heads, in which case the electrical industry could reasonably expect to secure a large part of such increase.

Taking this second possibility first, it might be thought that the very large group of miscellaneous expenses represented a pool from which expenditure could easily be diverted into electrical lines. Regarding the present fuel and light bill as a necessity, might not the luxury of a rather fuller electrical expenditure attract some money now spent on other luxuries? On examination of the details, however, this does not appear so hopeful. Large though this miscellaneous item is, some two-thirds of it is almost unavoidable under existing living conditions. Thus, out of a total of 25s. 7d. per week, 7s. 6d. is accounted for by medical expenses, insurances and trade union contributions, 4s. 1d. is for soap and household equipment, and 2s. 3d. for travel, apart from holidays. These and other virtual necessities leave a margin of only 7s. 6d. a week for the "luxuries" of nearly four people. These latter include tobacco and drink, entertainments, newspapers, holidays and holiday travel. Unless, therefore, one can persuade the working man to spend less on tobacco in order to purchase a little more electrical energy it looks as though an expansion of his heat and light budget will only come through an expansion of his income.

Next consider the prospects of a change-over within the existing total fuel and light expenditure. The total varies from 5s. 2½d. per week in July to 7s. 6½d. in January, and some details are given in the following table.

	July s. d.	*January* s. d.	Increase January over July Per cent.	Average for all 4 weeks s. d.
Coal and Coke ..	2 4	4 0¾	74	3 3
Gas	1 5	1 6¼	7	1 5½
Electricity	10½	1 1½	28	11¾
Oil, Wood, Candles	7	10	43	8¾
Total ..	5 2½	7 6½	45	6 5

The gas and electricity items include meter rent and fittings.

It is noteworthy that the bulk of the seasonal variation is due to the coal expenditure, the variation in electricity being much less and that of gas being almost negligible. These figures are very much what one would expect. It is obvious that space-heating is the most seasonal of the three major demands, lighting is less so, whilst cooking needs hardly vary at all with the calendar. The inference from the figures is that even in these working-class households there is comparatively little gas lighting, and certainly no gas fires.

Much the largest item in the power budget is the expenditure on coal, which accounts for just half the total. This may be regarded as comprising two portions—a fixed amount of 2s. 4d. (the July figure) each month plus a varying portion reaching a maximum of 1s. 8¾d. in January. Since no purely room heating fires are required in July, it may be inferred that only this fluctuating portion is for space heating whilst the "base load" of 2s. 4d. per week is represented by cooking and water-heating ranges. (There is, of course, the possibility of a certain amount of coal purchase at July prices for use later on. But with so many houses subdivided the difficulty of storage, together with the perennial difficulty of finding ready money for non-immediate needs, makes any extensive forward buying unlikely.)

As regards room heating *per se* the use of coal seems likely to continue, and it would require a very considerable change both in habits and income before the working-class household gave this up. In fact, however, it appears that nearly three-quarters of the coal bill is *not* spent in this way but goes to provide the non-seasonal services.

Here, surely, is a great opportunity for an expansion of the domestic electrical market. There may be something to be said on the score of cheerfulness (and even of economy, when labour is no object) for an open coal fire on a winter's day, but there is nothing to be said for having to brush out flues and light coal fires in July in order to heat the bath water or cook a meal. Here is a typical household, representative of several millions throughout the country, with a non-fluctuating element of coal expenditure of over £6 a year—equal to the whole of its gas and electricity expenditure put together. How much better it would be for the country's health and convenience if all this coal went to the power stations and the households were supplied with an electric cooking and water-heating service!

The total revenue of authorised undertakers from domestic premises in 1937–38 was £27.2 millions, or about £3 12s. per annum per domestic consumer. If a substantial proportion of these households are represented by the inquiry described above it is not difficult to foresee a doubling of the domestic electrical revenue, and without loss to the gas industry!

* *Ministry of Labour Gazette*, December, 1940.

Credit Insurance

Suppliers' Protection against Air-raid Losses

By Gordon Lowe

THE maintenance of turnover is possible only through the extension of credit facilities to customers, but non-payment for goods supplied may itself have the effect of damaging severely the financial structure of the credit giver. Whilst credit must be given, there is no necessity for the manufacturer to continue to run the credit risk which increases with every bombing attack made on this country and it is desirable, if not essential, that manufacturers of such apparatus should safeguard their own individual positions. Equipment of all kinds is in great demand for the fulfilment of orders placed by H.M. Government and, whilst on the surface the financial stability of many contractors may appear to be excellent, the deficiencies are hidden and become apparent to the creditor only at the time when his goods and debts are beyond rescue.

The risk of non-payment for goods supplied on credit terms owing to the insolvency of the purchaser (no limitation is placed on the causes of insolvency) is a risk which the insurance market is willing to accept. The policies have been brought into line with current trading conditions and the salient points of those most in demand to-day are the following.

Bills of Exchange

It is customary between some sellers and buyers for payment to be effected by means of an accepted bill of exchange, due for payment on an agreed date. The risk of loss owing to the insolvency of the acceptor on or before due date is one for which protection is offered up to 75 per cent. in the case of Home buyers. Such cover is not a guarantee that the bill will be met at due date, but it provides that should the insolvent estate not distribute 20s. in the £, the actual net loss will be diminished by a 75 per cent. insurance payment. In the event of an acceptor failing, the indemnification from the insurance company has to take place within one month from the date on which the administrator of the estate acknowledges indebtedness. The balance of 25 per cent. has to be retained by the drawer, principally as a safeguard to the insurance company, for this reduced risk will be sufficient to cause constant supervision of the account and co-operation in any steps which may be deemed advisable to enforce payment.

The loss of goods in air attacks may have serious repercussions upon suppliers, who should guard themselves against such risks. This article reviews the available methods of doing this

As the manufacturer will include his estimated profit on the transaction in his 25 per cent. risk, his actual capital loss should be appreciably less than the indebtedness not covered by the policy. No insurance is available in respect of bills drawn and accepted or goods delivered prior to application for cover and it will be the prime condition of the policy that the goods shall be sold, delivered and the relative bill of exchange accepted during its period, normally of twelve months. Provided the bill is accepted during the policy period it remains covered until its due date without payment of further premium although that due date may be several months after the expiration date of the policy. The bill of exchange policy can be issued in respect of an isolated bill ; a series of bills accepted by a number of approved customers during a twelvemonth ; or a series of bills accepted by one named and approved buyer during the policy period. On making application for cover, the manufacturer will be asked to supply the names and addresses of the customers whose bills he wishes to cover, the approximate credit limits for each at any one time, and the tenor of the various acceptances which will be drawn.

On giving instructions for the issue of a policy he will be asked to estimate the turnover he will realise with the approved customers during the following twelvemonth. As the insurance company accepts only three-fourths of the responsibility, premium is chargeable only on three-quarters of the turnover realised and declared as the bills are drawn. The premium rates will be dependent on the standing of the acceptors (as viewed by the underwriters after confidential investigation) and the length of the bills. The charge for insuring a three-months bill accepted by a motor manufacturer or aeroplane manufacturer of good standing would be approximately 1 per cent.; therefore the premium on a bill of £1,000 would amount to £7 10s.

If, at due date, the acceptor asks for an extension of the bill, the risk will be continued by the company against payment of proportionate additional premium. If on expiry of a policy the amount of the estimated turnover has not been fully attained, the premium in respect of the unused portion will be returned to the assured, provided that the returned amount does not exceed three-fourths of that originally paid.

A claim arises as soon as insolvency of the acceptor is estiab lished, but no limitation is imposed as to the manner in whch insolvency is brought about. In many cases failure is caused by mismanagement or over-trading, but to-day the damage done by indiscriminate bombing is as likely to bring financial downfall as any other of the manifold difficulties of ordinary commercial life.

Open Account and Continuous Insurance

Where no bill is given, the open credit transaction thus involved may be covered under the open account policy. The operation and application of this type of insurance is similar to that of the bill of exchange policy except that invoices have to be declared to the company instead of bills.

Many manufacturers have customers who place regular orders which involve the extension of a permanent credit figure. When a customer or customers operate on such a basis the recommendable method of insurance is the time or continuous policy. With such a policy the payment of a fixed premium provides cover for 75 per cent. of an agreed amount outstanding at any time during the policy period of twelve months irrespective of the turnover realised or the terms of payment in force. Again the principal condition is that sale and delivery shall take place during the policy period and an overlapping term of six months is allowed without charge after expiry during which payment for goods supplied within the policy period will mature.

This method of insuring against credit risks is advised only when the figure insured is a constant one, for the policy allows of no adjustment of premium and, if at times nothing is owing, premium will have been paid needlessly.

The premium for this type of policy shows a saving of approximately 1 per cent. per annum when compared with the proportionate rates for bill of exchange or open account insurance. Thus, using the example quoted above, the insurance of four consecutive three-months bills or invoices would involve a total premium payment equivalent to 4 per cent. in the year. A time policy in respect of the same customer would call for a premium rate of 3 per cent. per annum, *viz.*, £22 10s. For this premium the assured would be covered for 75 per cent. of £1,000 outstanding at any time during twelve months with an overlapping cover of a further six months for the last delivered items to mature.

Fluctuating Credits

Seasonal or fluctuating credits can be insured on this basis but adjustable in proportion to the risk run by the company. Premium is payable month by month on 75 per cent. of the maximum risk run by, and declared to, the company during each month. At inception of the cover the insurer will ask for a deposit premium equal in amount to that which he would earn should the full policy limit be outstanding for six months. The lesser premiums earned and calculated month by month are set against this deposit which is returnable up to one-half should it not be fully earned during twelve months.

Under this method of insurance protection is provided for a further six months after time expiry in order to permit items to mature but, with the adjustable policy, premium still becomes due on the proportion of these monthly reducing balances which is covered by the insurance.

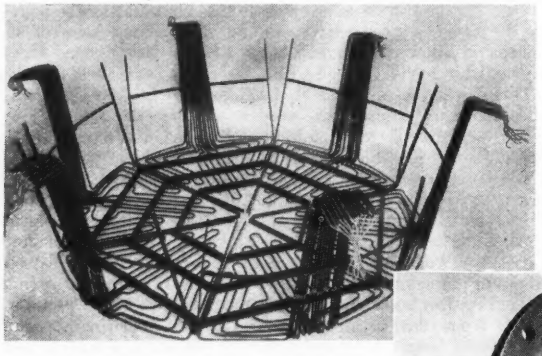
Claims made under time policies whether of a continuous or adjustable nature are handled in the same manner as under the bill of exchange and open account covers.

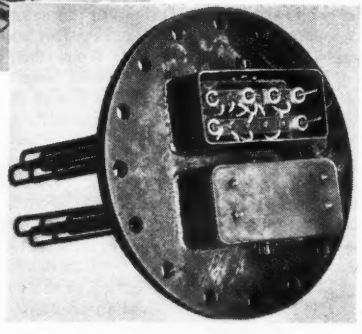
Comprehensive Insurance

A policy of this type embraces the whole of an assured's turnover whether on a cash or credit basis but, naturally enough, the inclusion of cash sales in the turnover declared to the company will be rightly reflected in the overall premium rate.

A necessary preliminary to the issue of a whole turnover policy is the completion of a proposal form giving certain details as to turnover and losses during at least the three previous years. This type of policy must be regarded purely as a catastrophic safeguard, for it operates on a first loss basis with the first loss bearing relation to the bad debts previously sustained. The form will also provide details of the number of credit clients and will permit of the agreement of an individual credit limit within which the assured is at liberty to gauge the credits he extends, provided, of course, that such facilities are justified by earlier experience or reliable information. The first risk will protect the insurance company against its client granting exorbitant credits to customers unworthy of them and it will also embrace those losses which past experience has demonstrated to be normal. The company will require to investigate and approve a small number of customers where credits will exceed the individual account limit and these will be specially endorsed to the policy schedule.

Subscription to such a policy entitles the assured to benefit without charge from the information services of the underwriter. This information service comprising many hundreds of thousands of files has been built up following years of experience of payments on the parts of thousands of firms and the company is frequently in a position to offer reliable, confidential advice as to the credit-worthiness of a proposed buyer. Assuming that an applicant realising a turnover of £500,000 per annum regularly experienced bad debts of £500 each year. He would be asked to carry a first loss of £500 and against payment of a minimum premium of £400 would receive 75 per cent. protection for all losses in excess of the £500 aggregate. Payment by the company would cease when it had settled £8,000 in any year. The amount of the policy (in this case £8,000) would, of course, be regulated by the size and number of the largest credit clients on the books of the assured party at the time the application for cover is made.





A 30-kW immersion heater for a bitumen vat and (below) an 11-kW oil immersion heater bank (with cover removed)

Whilst the insurance against losses on export credits proceeds entirely on the lines already indicated, such credits are able to benefit from a higher proportion of protection. In the majority of cases the cover afforded will be increased to 85 per cent. It will be realised that whilst the extension of credit abroad involves the running of risks quite similar to those taken in the home trade, there are other additional hazards, the majority of which are now susceptible to insurance protection. There are, for example, the risk of exchange restrictions not permitting the remittance of monies due, losses brought about as a direct consequence of war, civil commotion or invasion, loss on resale owing to existing conditions not permitting the delivery of goods specially manufactured and loss of profits following the increase in freight rates, marine insurance, Government war risk insurance, etc.

Delay in settlement on the part of an importer may be attributable first to his own pecuniary difficulties, but it is equally probable that he will be unable to remit owing to his country being unable to allocate sterling exchange. The loss caused by such a delay or by delay occasioned by war, civil commotion or invasion is insurable up to 90 per cent.

Special electrical equipment requires a period of time for manufacture. The advent of certain conditions such as the failure of the importer who has placed the order, war, civil commotion or invasion may make the delivery of the machinery impossible when manufacture is complete. To throw such specially prepared articles on the open market for the purpose of obtaining the best price possible is almost sure to involve the manufacturer in a loss. Such a loss is insurable either through a special policy or by means of a supplement to a comprehensive policy.

Pre-shipment Risks

The intensification of marine warfare has from time to time brought about a necessary increase in the marine insurance rates. The loss of shipping space has, in its turn, caused increases in the freight rates from this country to most other parts of the world. The sudden increase of either of these factors will probably make a vast difference to that share of a sale price which the exporter has ear-marked for his profit. The loss can be guarded against by means of insurance, as a policy is now available which will offer protection against increases in freight rates, marine insurance rates and Government war risk insurance rates.

Manufacturers and exporters subscribing to one or other of the various types of bad debt insurance outlined in this article take that step in the interests of the capital they have invested in their businesses. Apart from fulfilling this very important function, these credit insurance policies are accepted by banks and finance houses as first-class security. Accommodation is extended by the banks far more readily to a customer able to deposit a credit insurance policy as security than to a customer who has no other security to pledge than his own personal ability to meet the increasingly difficult conditions of commerce which are encountered to-day.

Special Purpose Heaters

ELECTRIC heating apparatus for unusual or special purposes is constantly being supplied by the Metropolitan-Vickers Electrical Co., Ltd. In a large number of cases general purpose elements are employed consisting of helical coils of nickel-chrome alloy wire embedded in crystalline magnesium oxide within tubular metal sheaths. These elements can be made in any combination of 8-ft. lengths to suit any type of container or they can be used for temperatures up to 750 deg. C.

Among typical equipments recently completed was a 2-kW element for a calender roll, 10½ in. outside diameter and 3 ft. long, used in a paper mill. The heater was inserted into the cylindrical calender from one end. It is held stationary while the calender is rotating. The turns of the resistance coil were arranged more densely at the ends to compensate for the heat loss at the ends of the roll. A three heat control switch and an easily removable terminal box were provided.

An oil immersion heater, comprising a bank of heating elements totalling 11 kW, mounted on standard pressure type steel flanges for withstanding a pressure of 150 lb. per sq. in., is another interesting item. Heaters of this type for oil heating can be supplied for pressures as high as 500 lb. per sq. in. The other illustration shows a 30-kW immersion heater for a large bitumen vat in a dip shop, for the impregnation of armatures and coils, in a large electric motor factory. Beaded tails are connected to busbars running round the edge of the vat. This heater boosts an existing steam coil heating at 100 deg. C, taking the temperature up to about 250 deg. C. Adjustable thermostatic control is fitted with a safety thermostat to prevent flash point being reached.

COMMERCIAL AND INDUSTRIAL NEWS

Purchase Tax Decisions. New Zealand Tariff. Balloon Barrage Damage

Purchase Tax Regulations

REGULATIONS governing the registration of manufacturers and wholesalers for the purposes of the Purchase Tax are set out in Statutory Rules and Orders No. 2194, 1940 (Purchase Tax (No. 2) Regulations, 1940). Copies can be obtained from the Stationery Office at 2d. each.

It is provided that applications for registration shall be made in a form approved by the Commissioners of Customs and Excise and the Commissioners may also require non-registrable manufacturers to provide such information as they may consider necessary and the same applies to manufacturers or wholesalers who appear to the Commissioners to be liable to register. A form of certificate of registration is scheduled to the Order and it is stipulated that the certificate should be kept as directed by the Commissioners. The methods of declaring goods liable to tax and of paying the tax are laid down.

The Commissioners of Customs and Excise have decided that insulating tape and insulating cloth prepared to conform to recognised electrical insulation standards is not taxable. Exemption is also given to exhaust fans designed for incorporating in the structure of buildings and cycle dynamo lighting sets.

New Zealand Tariff Decisions

Among recent decisions of the New Zealand Customs Department are the following :—Under the heading " Electrical machinery, appliances and materials," X-ray equipment and certain accessories imported with it are to be admitted free of duty under both the British preferential and general tariffs. Electric concrete vibrators, including the electric motor, are to be admitted free of duty under the British preferential tariff; the rate under the general tariff is 25 per cent. *ad valorem*. The same applies also to porcelain rainshed insulators, flanged for leading through castings, or insulators for transformers.

New Zealand Radio Import Prohibition

A Custom Import Prohibition Order prohibits the importation into New Zealand, save with the consent of the Minister of Customs, of wireless transmitting apparatus. Apparatus affected includes (1) any wireless transmitter designed for communicating by wireless telegraphy, wireless telephony or television, or for wireless fascimile transmission or for any other purpose; (2) electronic valves capable of an anode dissipation exceeding 10 watts; (3) piezo-electric quartz plates; (4) piezo-electric tourmaline plates cut to oscillate at a given frequency; and (5) any wireless receiving apparatus capable of being adapted for use as a wireless transmitter.

Alleged Trading with the Enemy

The hearing was concluded on January 29th, after a hearing lasting twelve days, of the case against Miss Doreen Grant Gibbons, a company director. Miss Gibbons, with her company, Electro-Chemical Products, Ltd., and two co-directors, Messrs. Louis F. Szilagyi and Thomas Ogle, was charged with having had financial and commercial dealings with the enemy. It was alleged that the defendants had had transactions with two Swedish concerns, Aktiebolaget Tudor & Aktiebolaget Nordring, which were German controlled. At an earlier stage of the proceedings, Messrs. Szilagyi & Ogle had pleaded "Guilty" on seven counts and were acquitted on another five. Mr. Justice Hilbery, after hearing evidence as to the good characters borne by the defendants bound them over for twelve months in the sum of £10 in their own recognisances and allowed them costs in respect of an adjournment of the case from the last session. Miss Gibbons, who pleaded " Not Guilty " to all charges, was found " Not Guilty " on three of them. The jury disagreed regarding the other seven counts and Mr. Justice Hilbery said that there must be a re-trial. Miss Gibbons was again allowed bail.

Flameproof Enclosure

The original B.S. 229 published in 1926, comprised a general definition of the term " flameproof enclosure," a general outline of the tests to establish the quality of flameproofness and a suggested form of certificate to be issued by the testing authority. The first revision in 1929 included a few small changes only. No attempt, up to that time, had been made to provide detailed directions for the design and construction of flameproof enclosures.

In the new 1940 edition the definition of the term " flameproof enclosure " remains substantially unaltered, but the specification has been considerably enlarged to include a detailed prescription for those features of design and construction which are considered to be essential to secure mechanical strength and reliability in service. The specification at present covers apparatus for use in coal mines only and amplifies the requirements of the Mines Department Testing Memorandum No. 4. Copies may be obtained from the British Standards Institution, Publications Department, 28, Victoria Street, London, S.W.1, price 2s. 3d. each, post free.

Balloon Barrage Damage

The Electricity Commissioners have notified authorised electricity undertakers that the Air Ministry has decided that as from February 1st any damage caused to their property by balloon barrage equipment will be treated as " war damage." Claims in respect of such damage should be sent to the Electricity Commissioners. Claims for damage due to drifting balloons prior to February 1st should be addressed to the Balloon Command, Royal Air Force, Stanmore, Middlesex.

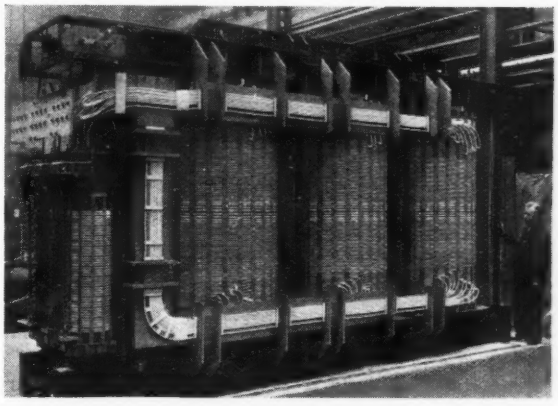
British Electrical Machinery in demand Overseas

In spite of wartime activities the G.E.C. has been able to maintain the manufacture of large transformers for export. The following details of some of the contracts recently completed give a representative picture of typical equipment produced.

A 10,000 kVA transformer, 33,000/11,000/6,600 V is designed so as to be readily transportable, complete with fittings, on the standard loading gauge, and is suitable for immediate service. These particular requirements have necessitated special design features so as to bring the physical dimensions of the transformer within the required limits while allowing an ample margin in the electrical output.

A rectifier transformer of 22,000 V has been constructed for use with a G.E.C. 12-phase 2,000 kW mercury arc rectifier installed in a traction sub-station. The connections and winding arrangement have been designed to ensure equal division of load between the two anodes involved, and, in addition, phase displacing windings are included on the high-tension side to enable two equipments to be operated in parallel as an effective 24-phase combination, if required.

A detail view of the core and windings of a G.E.C. 45,000 kVA transformer for electrical distribution, arranged for tap changing on load, is seen in the accompanying picture. The voltage ratio is 132 kV/33 kV



Core and windings of a 45,000-kVA G.E.C. transformer

and the view shows clearly the arrangement of the tapping leads and the " five leg " type of construction of the core.

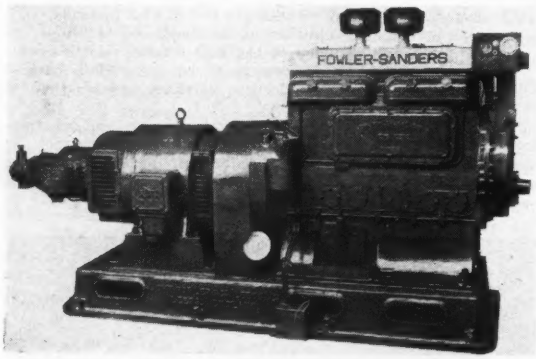
A 4,000 kVA transformer has recently been built for a Canadian Corporation for supplying an arc furnace. The transformation ratio is 6,600/230 V and the l.v. side is designed for a line current of 11,000 A. Tappings on the h.v. side are arranged to give alternative output voltages between line and neutral on the l.v. side of 85, 95, 105, 124 and 133 V. A separate reactor is mounted in the main transformer tank and connected in the h.v. side to give a total reactance, including the transformers, of 15, 25, 30, or 35 per cent. The voltage tappings and also the reactor tappings are taken to a link board from which preselected connections are run to a four-way externally operated tapping-switch, by means of which a sequence of four selected voltages with a value of reactance chosen for each, can be obtained. Cooling of the transformer is effected by means of an internal cooling tube.

Maintaining Vital Communications

To meet emergency conditions, Crompton Parkinson, Ltd., in association with John Fowler & Co. (Leeds), Ltd., have recently produced a compact self-contained Diesel generating set which will provide a reserve source of electric power for the building in which it is installed and in addition is of sufficient capacity to provide full service to the local telephone system. The engine used in this set is a Fowler-Sanders Diesel type

"6BH," rated for this particular duty at 90 BHP at 1,500 RPM. It has been designed essentially for heavy-duty work and is capable of maintaining its rated output over long continuous periods.

Electric starting equipment is provided and is operated by push-button from a control panel mounted on the engine. Hand starting gear is also fitted to the engine and is intended for emergency use. Directly connected by a flexible coupling to the Diesel engine is a Crompton Parkinson protected type revolving armature alternator, having an output of 50 kW at 1,500 RPM and fitted with overhung exciter. Engine and alternator are mounted together



Fowler-Sanders Diesel generator set, with a Crompton Parkinson protected type revolving-armature alternator

on a cast-iron combination baseplate. The baseplate is permanently mounted on a prepared concrete foundation bed, which is supported in turn on pedestal type "anti-vibrators." For control a cubicle type switchboard, mounted away from the set, carries all necessary instruments, including an automatic voltage regulator and an exciter shunt field regulator.

Rapidly Installed Switchgear

At present when switchgear is damaged by enemy action or when a new and rapid installation of gear is required, the primary object is to give a supply immediately, even at the expense of a certain measure of protection. Therefore, if the busbar chambers and feeder cable boxes can be rapidly installed and solidly coupled, an immediate supply is available, even though the conditions of operation lack certain of the usual advantages. Unfortunately the more usual designs of switchgear do not permit the busbar chamber and feeder cable boxes to be segregated, as the former, particularly, usually forms an integral portion of the switchgear, with the result that the complete unit must be manufactured before installation is possible.

In the case, however, of the Yorkshire Switchgear and Engineering Co.'s "IVI" type switchgear, the busbar chamber and cable box represent the whole of the stationary portion. The company tells us that it can effect a rapid delivery of these items, which are simple to install and which can be provided with means of solidly coupling the feeder cable to the busbars (by plug-in links) until the remainder of the gear is delivered.

Fire Prevention at Supply Authorities' Premises

We stated last week that the Electricity Commissioners are the "appropriate authority," for the purposes of the Fire Prevention (Business Premises) Order so far as electricity supply authorities are concerned. The Commissioners recently circulated a memorandum for the guidance of authorities in which they asked for particulars of schemes drawn up by the authorities to be sent to them by February 5th.

It was stated that in the case of buildings shared by authorities with other occupiers and in the case of offices and showrooms adjoining other business premises joint arrangements for fire prevention appeared to be appropriate. Joint arrangements could also be made with the occupiers of premises at which an authority had an unattended substation. Where an authority was unable to make arrangements for the presence of staff at isolated unattended substations the Commissioners would be prepared to notify their concurrence and thus relieve the undertakers from the obligations of Article 2 of the Order; such undertakings, however, should have regard to the possibility of making joint arrangements. The Commissioners would be prepared to approve the exemption from fire-prevention duties of "key" men required for emergency repair work and the restoration of air-raid damage.

London J.E.A. Salaries

Since last April the London & Home Counties Joint Electricity Authority has paid cost-of-living additions to the salaries and wages of members of its administrative, clerical and general staff in receipt of not more than £5 a week. The General Purposes Committee has now recommended that as from January 1st employees of 21 and over whose ordinary remuneration exceeds £4 15s. a week but does not exceed £300 per annum shall be granted a cost-of-living addition of 6 per cent. of their ordinary remuneration and that where the ordinary remuneration is over £300 but does not exceed £318 per annum, the addition shall be limited to so much as will bring the ordinary remuneration to £318.

Staff Salaries at Horsham

Although there was opposition to the proposal, the Horsham Urban Council decided last week to adopt the National Joint Board schedule of salaries for the staff of the electricity undertaking. The Finance Committee reported that the Electrical Power Engineers' Association had informed it that unless the Council intimated its agreement to adopt the schedule within seven days the matter would be submitted to the Minister of Labour under the Conditions of Employment Order.

Britannic Electric Cable Co.

In our issue of January 24th, under the heading "Liquidations," we reported that a meeting was to be held to receive an account of the winding-up of the Britannic Electric Cable and Construction Co., Ltd., by the liquidator of the company. It has been pointed out to us that the company concerned was formed to negotiate with regard to land and to arrange a sales organisation. It went into voluntary liquidation when the present company of the same name was formed. We are assured that this company is in a very healthy condition and we hasten to clear up any misunderstanding which may have arisen from the official notice.

Switchgear for War Use

Adverting to page 306 of our issue of January 31st, increasing demands are reported by Switchgear & Cowans, Ltd. for their internal isolation high-voltage switchgear in which the oil circuit breaker is mounted on the floor with a view to minimising mechanical shock. This type is being made for currents up to 3,000 A and for short-circuit ratings up to 500 MVA. The company's practice is to fit arc-control devices on circuit breakers of 250 MVA and upwards. Contacts for circuit breakers have been designed in conjunction with proving tests which have been carried out at the A.S.T.A. or N.P.L. stations on the company's gear up to 750 MVA. Low oil content breakers are among the other types for which there is a demand.

There has been considerable activity also in the production of 400 and 660-V industrial-type switchgear for currents up to 2,000 A and rupturing capacities up to 25 and 30 MVA.

Factory Lighting Regulations

The Factories (Standards of Lighting) Regulations came into operation last Saturday, February 1st.

Trade Announcement

The distribution of Perihel sun lamps is now being carried out by Perihel, Ltd., 10, Cullum Street, London, E.C.3. Heretofore, two companies were in charge of home and export sales, but the increased demand for this product has induced the proprietors to combine their activities. Mr. F. C. Beckett, late sales manager of Atlas Exporters and Importers has been co-opted to the board of Perihel, Ltd. Authorised distributors are being appointed throughout the country and their activities will be supported by local and national advertising.

Change of Address

The Magnet Engineering Co. is temporarily accommodated at 17, Percy Street, Liverpool, 8 (telephone: Royal 5764).

Edward Wolf & Co. have taken temporary accommodation at 31, Doyle Court, London Road, Portsmouth, and ask for catalogues and price lists to replace those destroyed.

The London office of G. & J. Weir, Ltd., has been removed to 41, Hills Road, Cambridge (telephone: Cambridge 55619; telegrams: Hydrokineter, Cambridge).

Catalogues and Lists

Latem Electrical Co., Eastwood Street, Hall Lane, Bradford.—Illustrated leaflet describing an iron-cased emergency lamp, with "dry" accumulator, for screwing to walls or ceilings.

B. E. N. Patents, Ltd., High Wycombe.—The "B. E. N. Bulletin" has been converted from a monthly to a bi-monthly publication, and is issued in a more up-to-date form.

INFORMATION DEPARTMENT

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the following:—

Multiple Fuses & Accessories, Ltd (Present address).

Portable winding trimmer for ends of armatures and rotors after soldering joints.

R.M.S. water heater.

TRADE MARK APPLICATION

AMONG recent applications for British trade marks is the following, objection against which may be entered within one month from January 29th:—

HOTPOINT. No. 611,350. Class 11 (IV). Electric fans.—The Hotpoint Electric Appliance Co., Ltd., 24 Newman Street, London, W.1.

ELECTRICITY SUPPLY

Opposition to Kent Power Bill. London J.E.A. Lighting Contracts

Acton.—SHELTER HEATING.—The Town Council has approved the installation of power cables in place of lighting cables when supplies are being given to public shelters so that electric heating can be installed.

Ardrossan (Ayrshire).—SHELTER HEATING.—The Public Health Committee is seeking authority to heat public shelters, either electrically or otherwise.

Ashton-under-Lyne. — MAINS EXTENSIONS.—In our January 24th issue under this heading we referred to mains extensions to be carried out by the Joint Electricity Board. This is the Stalybridge, Hyde, Mossley and Dukinfield Board, which has of course no connection with the Corporation electricity undertaking.

Bexhill-on-Sea. — INCREASED SALES. — Despite the restrictions on lighting and the economies brought about by the war the Borough Electricity Department increased its sales of electricity from 10,396,419 kWh in the year ended March 31st, 1939, to 11,453,036 kWh for the 1939-40 period. The financial result of last year's working shows a deficit of £3,923, which is much less than at first anticipated and actually £3,235 less than the loss for the previous year. Mr. R. C. Carter, the borough electrical engineer, states in his report that two factors have played an important part in this result, the decrease in the maximum charges and the increase of ¼d. per kWh in the two-part "unit" charge as from the commencement of the December quarter. In order to cope with a further estimated deficit for the year 1940-41, the Council has decided on a 20 per cent. increase in tariffs as from the commencement of the June quarter, 1940.

Brighton.—RING MAIN.—The Corporation Electricity Committee is to temporarily complete the northern ring main and provide a temporary switch kiosk at a cost of £687.

Canterbury.—OPPOSITION TO KENT POWER BILL.—The City Council has decided unanimously to oppose the Bill providing for the amalgamation of the undertakings of the South-East Kent Electric Power Co. Ltd. and the West Kent Electric Co. Ltd., with the undertaking of the Kent Electric Power Co., and conferring further powers on the Kent Electric Power Co. The Mayor, Alderman C. Lefevre, said that they would "certainly object to the endeavour to forestall the recommendations of the McGowan Report by the company jockeying itself into a favourable position."

Chester.—PUMPING STATION SUPPLY.—The Corporation Electricity Committee is to provide an electricity supply at a cost of £650 to a water pumping station of the Crewe Corporation.

Chesterfield.—SHELTER LIGHTING.— Electric lighting is to be installed by the Rural District Council in communal air raid shelters.

Clydebank. — STREET LIGHTING. — The Lighting Committee has accepted the offer of the Strathclyde Electricity Supply Co. to lay and joint the necessary services to 147 street lighting standards at Mountblow housing scheme, provided the Council pays £512 towards the cost.

Croydon. — OPPOSITION TO KENT BILL.—The Town Council has decided to oppose the Kent Electric Power Bill if it is found necessary to safeguard the town's interests.

Darlington.—MAINS AND SERVICES.—Sanction has been received by the Town Council to borrow £1,000 for electricity mains and services.

Hull.—SATISFACTORY POSITION.—Mr. D. Bellamy, general manager of the Hull Corporation electricity undertaking, reported to his Committee recently that in spite of largely increased costs no increase in existing charges was at present necessary. Coal had cost an additional outlay of £37,000 and the net expenditure to the end of March on air-raid precautions would be £33,633. The estimated income for the current year would be £904,468, and the estimated surplus on revenue account £48,297. The Committee has complimented the manager and staff on the very satisfactory financial position.

Jarrow-on-Tyne.—LIGHTING OF SCHOOL SHELTERS.—Battery lighting is to be provided in school shelters.

London.—LEWISHAM.—Reporting with regard to the heating of public shelters, the Borough Council Emergency Committee states that the London Civil Defence Region indicated in December that coal burning stoves were to be supplied centrally for installation in surface shelters holding 50 or more persons in one compartment and in trench shelters. The Committee has considered a report from the town clerk pointing out that owing to the number of shelters and their dispersal generally in small units throughout the borough the maintenance of coal burning stoves would entail a volume of work for which it would be difficult to obtain labour, and in addition it was doubtful whether sufficient coal would be available to maintain a supply for the stoves throughout the winter; the cost of the maintenance of coal stoves for labour and fuel would be in the neighbourhood of £8,000 a year. The Committee considered an alternative method of heating the shelters, namely, by the use of tubes fitted with elements heated electrically on the thermostatic principle, which, while it would cost approximately £5,000 to install, would involve considerably lower maintenance charges and would obviate any risk which might occur from coal fires in shelters. Experiments had already been tried with this form of heating in one of the shelters and found to be satisfactory and the Committee was of opinion that this system should be adopted.

LONDON.—J.E.A. LIGHTING CONTRACTS.—The Local Distribution Committee of the London & Home Counties Joint Electricity Authority proposes that local authorities having street-lighting contracts with the J.E.A. shall be charged 50 per cent. of the normal annual charges based upon the actual accounts rendered before the war, with an adjustment in respect of the last four months of 1939 to enable the Authority to recover a third of the m.d. charge for 1939 and a similar adjustment, if necessary, to safeguard the Authority against loss on m.d. account in the year when street lighting is resumed. It is also proposed that a further reduction in charges shall be considered, to the extent of loan charges falling out during this temporary arrangement, and that the period of street-lighting contracts should be extended by the addition of the war period, subject to the right of the Authority to apply for a revision of charges on account of increased costs when normal lighting is resumed.

Manchester.—LIGHTING CONCESSION.—In order to assist consumers whose windows have had to be boarded up as a result of air-raids the Electricity Committee has decided to give flat rate or prepayment meter consumers the option of transferring for the time being to the all-in tariff, without the usual obligation to remain on the tariff for not less than twelve months.

Menai Bridge.—LLANDEGFAN SCHEME.—It was reported at a recent meeting of the Urban District Council that the North Wales Power Co. had completed the contract for the Llandegfan electrification scheme.

Morecambe.—MAKING APPARATUS LAST.—An appeal has been made to consumers to co-operate with the Electricity Department in making electrical apparatus last as long as possible in view of the great difficulty in obtaining spares.

Nelson.—SCHOOL SHELTER LIGHTING.—The Education Committee is to have electric lighting installed in the school shelters.

Northampton. — NEW CABLE. — The Northampton Electric Light & Power Co., Ltd., is to lay a cable in the Promenade at Beckets Park.

Nottingham.—ELECTRICITY CHARGES.—No increase in the charges for electricity is contemplated, according to Councillor F. Mitchell, chairman of the Corporation Electricity Committee. Some months ago higher charges were discussed, but the increased consumption of electricity has enabled the Committee to keep the price at a reasonable level.

Oswaldtwistle.—STREET LIGHTING.—The Urban District Council has decided to introduce modified street lighting in the main thoroughfare.

Penrith. — LIGHTING OF LIBRARY.—The U.D.C. Library Committee recommends the installation of electric lighting in the library part of the Town Hall as soon as opportunity occurs.

Sheffield.—MAINS EXTENSIONS.—The Corporation Electricity Committee has approved expenditure of £4,516 on mains extensions.

Stafford.—HOUSE WIRING.—The Town Council has approved the expenditure of £1,450 on wiring for electricity new houses on the Silkmore Estate.

Wallsend-on-Tyne. — MAINS EXTENSIONS APPROVED.—The Town Council has approved plans submitted by the North-Eastern Electric Supply Co., Ltd., for low-voltage cables in Willington Terrace and Embleton Avenue.

Warrington.—MAINS EXTENSIONS.—The Town Council proposes to extend the electricity mains between Golborne Street and Barbould Street substations.

Watford.—FIRES FOR WARDENS.—Electric fires are to be provided at wardens' posts at a cost of £30.

Weymouth. — DISTRIBUTION ARRANGEMENTS.—The Town Council is to submit for approval a scheme for laying mains, and switchgear equipment, to link up the eastern and western areas, at an estimated cost of £12,625.

Willesden. — YEAR'S WORKING. — During 1939-40, the sales of electricity by the Borough Electricity Department (engineer and manager: Mr. J. D. Spark) totalled 82,271,199 kWh, as compared with 85,736,778 kWh in the preceding year. Revenue declined from £398,940 to £387,102 while the working expenditure increased from £300,938 to £302,255, leaving a gross profit of £84,847 (£98,001). The net profit at £17,845 was £18,924 lower than in 1938-39.

United States.—NEW HYDRO STATION STARTED UP.—The *Electrical World* reports that the Grand River (Oklahoma) hydro-electric scheme, which has been financed by the P.W.A., is ready to undertake contracts for the supply of power to public and private companies for distribution. The work was commenced in 1938 and was originally intended to be completed in January last, but the period was later extended to December 31st. The initial plant installation consists of four 16,000-kVA, 90 per cent. power factor generators, driven by 20,000-HP Francis type turbines, and a 750-kW house set. Provision is made for the installation of two further sets.

TRANSPORT

Doncaster.—TROLLEY-BUS EXTENSION.—It is proposed to extend the trolley-bus service from Beckett Road to Worcester Avenue to serve the Wheatley Park estate.

Glasgow.—INCREASED TRANSPORT.—Although the Underground was closed for almost four months Glasgow Corporation's transport system carried 10 million more passengers and increased revenue by £350,000 from May 31st, 1940 to January 25th, 1941. The Underground has now reopened after undergoing extensive repairs.

RADIO AND TELEPHONY

Enfield.—RADIO FOR THE FIRE BRIGADE.—A local scheme for two-way wireless telephony for the brigade has been approved by the Fire Brigade Committee of the Urban District Council.

Glasgow.—POLICE AND FIRE RADIO.—The Corporation Police Committee has approved a scheme for police communication in thickly populated areas by the use of very high frequency wireless at an estimated cost of £7,533. A separate wireless service for the use of the fire brigade is estimated to cost £5,853.

Manchester.—PURCHASE OF WIRELESS EQUIPMENT.—The Corporation Emergency Committee is to purchase wireless transmitting and receiving equipment at a cost of £1,700.

Morecambe.—RADIO RELAY RENTALS.—No objection has been raised by the Town Council to the proposal of the K.L.M. Rediffusion Service to increase the rental charge from 1s. 6d. to 1s. 9d. per week.

Scunthorpe.—SHORT-WAVE RADIO FOR A.R.P.—The Town Council is contemplating the use of short-wave wireless for its A.R.P. services.

Tynemouth.—WIRELESS FOR THE POLICE.—The Watch Committee is to obtain tenders for wireless installation for the police.

United States.—TELEVISION DEVELOPMENTS.—A British United Press message states that private interests in the United States are spending about £1,600,000 to develop television on a commercial basis. Ten new stations, six of them in Los Angeles, have been licensed by the Federal Communications Commission.

China's Electrical Trade

Progress Despite Political Disturbance

THE Chinese Maritime Customs has continued to issue periodical returns of the country's foreign trade, in spite of political upheavals and interference. The accompanying table showing the imports of electrical goods and apparatus in 1939 has been extracted from the annual statement, and notes of increases or decreases compared with 1938 have been added.

It is noteworthy that many branches of the trade have progressed, *e.g.*, radio, the lower capacities of machinery and the lighter appliances, although there was a marked drop in imports of unspecified electrical machines. While Germany lost ground in several lines Japan improved her position throughout. Values are in the Chinese gold unit, which averaged 33 5/16d. in 1938 and 36¼d. in 1939.

The trade of China as a whole has suffered further interruptions. In Shanghai and other treaty ports depression has grown, and there have been increased troubles over currency, exchange and complicated trade controls. Access to both coastal and interior markets has been restricted. More ports have fallen into Japanese hands and as a result have been utilised very largely for the transit of goods to and from Japan. Trade with the free China of Chiang-Kai-shek was hampered by the closing of the Burma Road (recently reopened) and has been interrupted increasingly by Japanese incursions in Indo-China. But always in China, in spite of upheavals through war, flood or famine, some amount of trade has persisted. The country's economic resources are rich and varied. They include two products—antimony and tungsten—in particular demand for war purposes, together with many foodstuffs, textile fibres, vegetable oils, and minerals.

	1939 Gold Units (000)	Inc. or dec. on 1938 Gold Units (000)
Electric lamps and lampware—		
Total	217	− 226
From Germany	10	− 261
„ United Kingdom	3	− 7
„ United States	6	− 12
„ Japan	147	+ 42
Electric fans and accessories—		
Total	56	− 13
From United Kingdom	9	− 1
„ Japan	27	− 30
Flashlights and torch cases—		
Total	65	− 7
From Hong Kong	38	− 3
„ United States	1	− 6
„ Japan	26	+ 4
Radio dials, wire, microphones, loud speakers, transmitting valves, transformers and condensers—		
Total	140	+ 18
From Germany	27	+ 6
„ Japan	11	− 6
„ United States	89	− 13
Receiving valves, battery eliminators, plugs, sockets, etc.—		
Total	106	− 44
From United Kingdom	11	− 9
„ Japan	10	− 7
„ United States	84	− 40
Complete transmitting sets, lightning arrestors, switches, etc.—		
Total	142	+ 128
From United Kingdom	73	+ 68
„ Japan	40	+ 37
„ United States	26	+ 3
Complete radio receiving sets and units—		
Total	298	+ 59
From Germany	10	− 12
„ United Kingdom	12	− 6
„ Japan	82	+ 68
„ Holland	14	+ 12
„ United States	178	− 14
Other telegraph and telephone instruments and materials—		
Total	866	+ 164
From Belgium	287	+ 142
„ Germany	140	− 221
„ United Kingdom	28	− 46
„ United States	28	− 32
„ Japan	171	+ 82

	1939 Gold Units (000)	Inc. or dec. on 1938 Gold Units (000)
Electric lamps—		
Total	362	+ 122
From Germany	13	+ 7
„ Japan	316	+ 108
„ United States	18	+ 8
Accumulators and cells—		
Total	345	+ 47
From Germany	24	− 5
„ United Kingdom	9	− 7
„ Hong Kong	13	+ 8
„ Japan	150	+ 66
„ United States	138	− 30
Electric meters and parts—		
Total	540	+ 286
From Germany	62	+ 4
„ Switzerland	23	+ 3
„ United Kingdom	78	+ 48
„ United States	98	+ 37
„ Japan	197	+ 128
Electrical appliances, unspecified—		
Total	265	+ 87
From Germany	16	− 13
„ United Kingdom	20	+ 11
„ Japan	87	+ 28
„ United States	130	+ 25
Electric cables—		
Total	757	− 46
From Germany	87	− 116
„ United Kingdom	226	+ 140
„ Japan	289	− 26
„ Belgium	82	− 35
Insulated wire and flex—		
Total	1,627	− 211
From Germany	547	+ 30
„ United Kingdom	114	− 179
„ Japan	585	− 53
„ United States	101	− 5
Insulators, fuse boxes, plugs, switchboards, etc.—		
Total	359	+ 141
From United Kingdom	24	+ 11
„ Japan	275	+ 134
„ Germany	13	− 20
Switches—		
Total	135	+ 51
From Japan	111	+ 44
Electric condensers and parts—		
Total	22	+ 13
From Japan	18	+ 11

	1939 Gold Units (000)	Inc. or dec. on 1938 Gold Units (000)
Other electrical fittings and materials, unspecified—		
Total	628	+ 132
From Germany	53	− 17
„ United Kingdom	80	+ 13
„ Japan	345	+ 121
„ United States	92	+ 4
Dynamos and generators and parts, not over 20 kW—		
Total	75	+ 23
From Germany	10	− 5
„ United Kingdom	9	− 1
„ United States	34	+ 16
„ Japan	13	+ 8
Ditto, over 20 kW—		
Total	89	− 10
From United Kingdom	10	− 10
„ Switzerland	50	+ 50
„ United States	23	+ 9
Electric motors and parts, not over 20 kW—		
Total	1,003	+ 185
From Germany	248	+ 86
„ United Kingdom	239	+ 166
„ Japan	439	− 43
„ Sweden	31	− 16
„ United States	26	− 1
Ditto, over 20 kW—		
Total	237	− 74
From Germany	26	− 26
„ United Kingdom	72	+ 20
„ Japan	126	− 50
Transformers and parts, not over 200 kVA—		
Total	255	+ 75
From Germany	25	− 6
„ United Kingdom	2	− 14
„ Japan	182	+ 84
„ United States	4	+ 1
Ditto, over 200 kVA—		
Total	115	− 112
From United Kingdom	22	− 27
„ Japan	82	− 16
Electrical machinery, unspecified—		
Total	490	− 365
From Germany	57	− 61
„ United Kingdom	126	− 225
„ Japan	213	− 67
United States	41	− 114

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specifications (1s. each) can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1939

17015. "Electrical oscillation generators." Marconi's Wireless Telegraph Co., Ltd., and W. S. Mortley. June 9th, 1939. (531755.)

18841. "Manufacture of insulated wire and varnish for use therein." Schenectady Varnish Co., Inc. July 25th, 1938. (531615.)

18982. "Devices for varying the operative length of wire in electrical circuits." D. McLennan. June 29th, 1939. (531687.)

19314. "Lead presses." British Thomson-Houston Co., Ltd. July 2nd, 1938. (531617.)

19378. "Suction cleaners." Hoover, Ltd. July 11th, 1938. (531546.)

19419. "Electric control switches for machine tools." R. Knote. February 17th, 1939. (531689.)

19502. "Lead pressing machines for producing tubes and for covering cables." Schloemann Akt.-Ges. August 5th, 1938. (531618.)

19509. "Sealing of molybdenum members into glass." Philips Lamps, Ltd. July 7th, 1938. (531823.)

19543. "Electric circuit arrangements provided with a magnetic permeability control device." E. A. Green and W. S. Challis. July 5th, 1939. (531553.)

19566. "Radio communication systems." Standard Telephones & Cables, Ltd., and P. H. Spagnoletti. July 5th, 1939. (531554.)

19567. "Visual indicators operated by pulsating currents." Standard Telephones & Cables, Ltd., and E. G. Seath. July 5th, 1939. (531555.)

19568. "Arrangements for suppressing the carrier frequency on transmission systems." Standard Telephones & Cables, Ltd., R. A. Meers, G. O. Probert and E. A. Rattue. July 5th, 1939. (531556.)

19575. "Electric fuses." British Thomson-Houston Co., Ltd. July 6th, 1938. (531620.)

19669. "Insulated electrical conductors." Pirelli-General Cable Works, Ltd., and H. Barron. July 6th, 1939. (531622.)

19714. "Radio receiving apparatus." R. M. Electric, Ltd., and G. H. Bradbury. July 6th, 1939. (531623.)

19723. "Process for improving the electric insulation resistance of glass wool or glass fibres." British Thomson-Houston Co., Ltd. July 8th, 1938. (531624.)

19744. "Coin-freed prepayment meters." F. S. Ash, A. Bates and Metropolitan-Vickers Electrical Co., Ltd. July 6th, 1939. (Cognate application, 12615/40. (531825.)

19839. "Thermionic valves." Standard Telephones & Cables, Ltd., and R. R. Back. July 7th, 1939. (531628.)

19975. "Impulse senders for use in telephone or like systems." R. Mercer. (Associated Electric Laboratories, Inc.). July 8th, 1939. (531693.)

19989. "Electron discharge valve amplifiers." E. L. C. White. July 10th, 1939. (531827.)

20018. "Electron discharge devices for use in television and like systems, and electrodes therefor." Baird Television, Ltd., and P. W. Willans. July 10th, 1939. (531828.)

20347. "Television reproducer tubes." Marconi's Wireless Telegraph Co., Ltd., and L. M. Myers. July 12th, 1939. (531760.)

20348. "Piezo-electric crystal controlled oscillation generators." Marconi's Wireless Telegraph Co., Ltd., and G. P. Parker. July 12th, 1939. (531639.)

20622. "Clothes wringers." British Thomson-Houston Co., Ltd. July 15th, 1938. (Addition to 527482.) (531761.)

20727. "Manufacture of metal castings." R. W. Bailey, H. H. Burton, G. B. Winder, Metropolitan-Vickers Electrical Co., Ltd., and English Electric Steel Corporation, Ltd. July 17th, 1939. (Cognate application 13195/40.) (531832.)

21478. "Electrical testing arrangements." General Electric Co., Ltd., E. H. Croft and H. Randall. July 24th, 1939. (531762.)

21703. "Resistance thermometers." Breeze Corporations, Inc. August 10th, 1938. (531569.)

21741. "Means for anchoring the tubes of elastic fluid generators to furnace walls." British Thomson-Houston Co., Ltd. July 26th, 1938. (531573.)

21742. "Electric transformers." British Thomson-Houston Co., Ltd. July 26th, 1938. (531574.)

21743. "Make-alive electrodes of electric discharge devices." British Thomson-Houston Co., Ltd. July 26th, 1938. (531575.)

21775. "Method of manufacturing an electrode system exhibiting unsymmetrical conductivity and comprising a selenium electrode." Philips Lamps, Ltd. July 29th, 1938. (531580.)

21780. "Automatic or semi-automatic telephone systems." R. Mercer. (Associated Telephone & Telegraph Co.). July 26th, 1939. (531581.)

21801. "Vertical grinding machines." Wright Electric Motors (Halifax), Ltd., and H. H. Wright. July 27th, 1939. (531584.)

21810. "Timing devices for electric circuits." British Thomson-Houston Co., Ltd. July 28th, 1938. (531585.)

21811. "Heat treatment of copper alloys in wire or strip form." British Thomson-Houston Co., Ltd. July 29th, 1938. (531586.)

21813. "Electrode or die for electrical resistance welding, and a method for the production thereof." E. G. Budd Manufacturing Co. July 27th, 1938. (531587.)

21850. "Arrangements of insulated metal-clad electrical apparatus affording facilities for testing the insulation." English Electric Co., Ltd., and A. R. Blandford. July 27th, 1939. (Cognate application, 10111/40.) (531591.)

21853. "Lead-in bushings for electric refrigerating apparatus." Patentverwertungs-Ges. Hermes. July 27th, 1938. (531592.)

21876. "Electric circuit breakers." G. Dewar and Metropolitan-Vickers Electrical Co., Ltd. July 27th, 1939. (Addition to 479953.) (531598.)

21882. "Magnetic chucks." Y. Naruse. July 27th, 1939. (531600.)

21895. "Electrode feeding mechanism for electric arc apparatus." S. F. Warren. (Warner Bros. Pictures, Inc.). July 27th, 1939. (531604.)

21928. "Systems and apparatus for effecting modulation of radio frequency energy." W. O. Duncan. (Intercontinental Service Corporation.) July 28th, 1939. (531646.)

21947. "Gas blast circuit breakers." Akt.-Ges. Brown, Boveri & Cie. November 17th, 1938. (531650.)

21963. "Circuits for operating high pressure metal vapour electric discharge devices." General Electric Co., Ltd., and V. J. Francis. July 28th, 1939. (531652.)

21964. "Television receivers." General Electric Co., Ltd., and T. R. Cowley. July 28th, 1939. (531653.)

21980. "Apparatus for mounting the filaments of electric lamps and the like." British Thomson-Houston Co., Ltd. July 29th, 1938. (531657.)

21982. "Lighting fittings." British Thomson-Houston Co., Ltd., and R. H. Finch. July 28th, 1939. (531658.)

21991. "Wave filter." Standard Telephones & Cables, Ltd. July 28th, 1938. (Cognate applications, 21992/39 and 21993/39.) (531662.)

21994. "Condenser dielectrics and methods of preparing them." Standard Telephones & Cables, Ltd. August 31st, 1938. (531663.)

22001. "Electric plug and socket devices." Friemann & Wolf Ges. July 28th, 1938. (531664.)

22075. "Electrolytic condensers." British Thomson-Houston Co., Ltd. July 30th, 1938. (531706.)

22076. "Protective devices for liquid immersed electrical apparatus." British Thomson-Houston Co., Ltd. July 30th, 1938. (531707.)

22091. "Automatic amplification and black-level control for television receivers." Hazeltine Corporation. August 26th, 1938. (531711.)

22092. "Scanning-wave generator synchronising system." Hazeltine Corporation. August 26th, 1938. (531765.)

22093. "Electric timing system, particularly applicable in television." Hazeltine Corporation. August 26th, 1938. (531712.)

22161. "Television circuits." General Electric Co., Ltd., and B. J. O'Kane. July 31st, 1939. (531724.)

22170. "Elastic fluid turbines." British Thomson-Houston Co., Ltd. July 30th, 1938. (531727.)

22171. "Windings for electrical apparatus." British Thomson-Houston Co., Ltd. July 30th, 1938. (531728.)

22172. "Control systems employing electric discharge devices, and applicable especially to the control of spot welding operation." British Thomson-Houston Co., Ltd. July 30th, 1938. (531729.)

22202. "Barrier-joints for electric cables." Callender's Cable & Construction Co., Ltd., and D. T. Hollingsworth. July 31st, 1939. (531767.)

22226. "Pick-ups for sound reproduction." Philips Lamps, Ltd. August 2nd, 1938. (531740.)

22281. "Apparatus for temporarily laying electric cables." E. A. Dennison, and Kennedy & Kempe, Ltd. August 1st, 1939. (531769.)

22294. "Alkaline accumulators." H. Lubeck, and Allmänna Svenska Elektriska Aktiebolaget. August 1st, 1939. (531772.)

22295. "Electric accumulators." H. Lubeck, and Allmänna Svenska Elektriska Aktiebolaget. August 1st, 1939. (531773.)

22297/8. "Electric accumulator batteries." H. Lubeck and Allmänna Svenska Elektriska Aktiebolaget. August 1st, 1939. (531774/5.)

22319. "Transmission and reception of frequency-modulated waves." Standard Telephones & Cables, Ltd. August 24th, 1938. (531779.)

22347. "Apparatus for the electrical precipitation of suspended particles from gaseous fluids." Lodge-Cottrell, Ltd. (Siemens-Lurgi-Cottrell-Elektrofilter-Ges. für Forschung und Patentverwertung). August 1st 1939. (531784.)

(*Continued on next page*)

FINANCIAL SECTION

New Companies. Capital Returns. Debenture Charges. Bankruptcies and Liquidations. Reports and Dividends. Stocks and Shares

Reports and Dividends

The Westinghouse Brake & Signal Co., Ltd., reports a trading profit, including dividends and interest to September 30th, after depreciation, working expenses and taxation, of £162,573 as compared with £91,932 for 1938-39. From this is deducted directors' fees, £2,792, leaving £159,781. General reserve receives £50,000, staff pensions £5,000, reserve for contingencies £25,000 and reserve for investments £13,293. The dividend for the year is maintained at 10 per cent., less tax and £92,384 is carried forward (against £90,432 brought in).

R. B. Pullin & Co., Ltd.—Presiding at the annual meeting on January 30th, Mr. R. B. Pullin (chairman) said that their subsidiary company, the Pullin Optical Co., Ltd., made a substantial profit on its first year's trading, and the works were engaged to full capacity. While the full energies of their organisation were directed to the national effort, the directors were keeping in mind the necessity of building up activities which would have a peacetime application, and they had during the past year acquired a controlling interest in two other companies, which in addition to their wartime activities, had an established peacetime business. They were Measuring Instruments (Pullin), Ltd., and S. A. Fane (High Wycombe), Ltd. With regard to 1941, the orders in hand had once again reached a record figure.

Benham & Sons, Ltd., held their annual meeting on January 30th, when Mr. S. J. Benham (managing director), who presided, said that their total turnover during the past year was over £360,000 more than the previous year. The chief increase had been in the cooking apparatus department, which was responsible for more than half of their turnover. They also had some large heating contracts and other work for the Government. They had recently taken over five smaller factories in addition to their main works.

The Power Securities Corporation, Ltd., is paying a dividend of 6 per cent. on the ordinary shares for 1940 (against 7 per cent.). The net revenue was £48,973 (against £75,897).

New Companies Registered

J. & G. Coughtrie, Ltd.—Private company. Registered in Edinburgh, January 20th. Capital £200. Objects: To carry on business as manufacturers and repairers of, and dealers in, dynamos, motors, armatures, magnetos, batteries, conductors, transformers, convertors, switchboards, stoves, cookers, glass, and electrical plant of all kinds, &c. Directors: J. A. Coughtrie, 69, Mavisbank Gardens, Bellshill, and G. R. Taylor, 30, Viewpark Road, Motherwell. Registered office: Erskine Square, Hillington, Glasgow, S.W.2.

G. Salter, Ltd.—Private company. Registered January 22nd. Capital £1,000. Objects: To acquire the business of an electrical and wireless engineer and dealer carried on by G. Salter, at Ellesmere Port. Directors: G. Salter and E. M. Salter, both of 12, Deeside, Whitby, and A. F. Johnstone, The Bungalow, Woodland Road, Whitby, Wirral. Registered office: 3, The Broadway, Whitby Road, Ellesmere Port, Cheshire.

A. G. Bruty, Ltd.—Private company. Registered in Dublin, January 21st. Capital £10,000. Objects: To carry on the business of electricians, mechanical engineers and manufacturers, and workers and dealers in electricity, motive power and light, &c. Directors: A. G. Bruty and A. O. Bruty, 7/8, Eden Quay, Dublin.

Duratube & Wire, Ltd.—Private company. Registered January 21st. Capital, £5,000. Objects: To carry on the business of manufacturers of, and dealers in, plastic and thermoplastic materials, modelling and moulding materials, rubber, gutta-percha, vulcanite, and goods manufactured therefrom, manufacturers of insulation sleevings, covered wires and cables, &c. Directors: J. F. Kenure, Arosfa, Hanworth Road, Feltham, Middlesex; P. Turner and T. McC. Scott, addresses not stated; and A. J. Lewis, St. Elmo, Cardinal Road, Feltham. Registered office: 16, Hanworth Road, Feltham.

Companies' Returns

Statements of Capital

Tungstone Accumulator Co., Ltd.—Capital £1,000 in 1,000 shares of £1 each. Return dated September 30th, 1940. 500 shares taken up. £500 paid. Mortgages and charges: Nil.

Boroughbridge Electrical Co., Ltd.—Capital £500 in £1 shares. Return dated October 16th, 1940. 100 shares taken up. £100 paid. Mortgages and charges: Nil.

Dowsing Co. (Electrical Manufacturers), Ltd.—Capital £15,000 in £1 shares. Return dated October 13th, 1940. 12,551 shares taken up. £11,051 paid. £1,500 considered as paid. Mortgages and charges: £3,300.

Increase of Capital

Weir Electrical Instrument Co., Ltd.—The nominal capital has been increased by the addition of £3,000 in £1 shares, beyond the registered capital of £3,000.

Mortgages and Charges

Bylock Electric, Ltd.—Particulars filed of £4,000 second debentures authorised January 8th, 1941, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Ismay Distributors, Ltd.—Mortgage on a certain debt due to the company, dated December 13th, 1940, to secure £6,500. Holders: Sterling Electric Holdings, Ltd., Sterling Works, Dagenham.

Turner & Booth, Ltd.—Mortgage on land and 19, Carlisle Road, Birkdale, Lancs, thereon, dated January 2nd, 1941, to secure £100. Holder: Mrs. L. V. Wardle, 76, Halsall Road, Southport.

Liquidations

John Lightfoot, Ltd.—Meeting pursuant to section 236 of the Companies Act, 1929, on March 7th at Bank of England Chambers,

(*Continued on page 357*)

New Patents (*Concluded from page 353*)

22348. "Apparatus for the electrical precipitation of suspended particles from gases." Lodge-Cottrell, Ltd. (Research Corporation). August 1st, 1939. (531785.)

22368. "Eddy-current dynamometers." Heenan & Froude, Ltd., and E. G. Ross. August 2nd, 1939. (531787.)

22380. "Temperature compensated induction meter." Landis & Gyr Akt.-Ges. June 3rd, 1939. (531788.)

22403. "Bimetallic thermostats." Westinghouse Electric International Co. August 17th, 1938. (531793.)

22404. "Thermostats." Westinghouse Electric International Co. August 27th, 1938. (531794.)

22418. "Electrical filter networks." Siemens Bros. & Co., Ltd., and M. Reed. August 2nd, 1939. (531789.)

22424. "Wire drawing machines." British Insulated Cables, Ltd., W. J. Clements and F. T. Cleaver. August 2nd, 1939. (531799.)

22459. "Electrolysers with external circulation of the electrolyte, more particularly for the electrolysis of water." Maschinenfabrik Oerlikon. August 6th, 1938. (531804.)

22469. "Inductance coils." Automatic Telephone & Electric Co., Ltd., and C. Rhodes. August 2nd, 1939. (531807.)

22502. "Apparatus for dispensing mercury or similar substances." British Thomson-Houston Co., Ltd. August 6th, 1938. (531811.)

22503. "Methods of introducing mercury into a container." British Thomson-Houston Co., Ltd. August 6th, 1938. (531812.)

22514. "Circuit closing and releasing mechanism for prepayment electricity meters." Sodeco, Soc. des Compteurs de Genève. August 5th, 1938. (531840.)

22523. "Piezo-electric substances, and processes for producing them." Electrical Research Products, Inc. August 4th, 1938. (531841.)

22538. "Means for illumination, comprising both an electric discharge device and an incandescent filament." General Electric Co., Ltd. (Patent-Treuhand-Ges. für Elektrische Gluhlampen.) August 3rd, 1939. (Addition to 485954.) (531844.)

22542. "Apparatus for temporarily laying electric cables." E. A. Dennison and Kennedy & Kempe, Ltd. August 3rd, 1939. (531845.)

22549. "Vacuum seals for electric discharge apparatus." British Thomson-Houston Co., Ltd. and J. W. Boag. August 3rd, 1939. (531848.)

22677. "Electric discharge devices." General Electric Co., Ltd., and M. Pirani. August 4th, 1939. (531867.)

22681. "Luminairs." Holophane, Ltd. (T. W. Rolph.) August 4th, 1939. (531868.)

22704. "Electrically driven gyroscopes." Askania-Werke Akt.-Ges. August 4th, 1938. (531870.)

22718. "Magneto-striction oscillators." Fides Ges. für die Verwaltung und Verwertung von Gewerblichen Schutzrechten. August 4th, 1938. (531871.)

25251. "Electric furnace with radiating resistances." Soc. Anon des Manufactures des Glaces et Produits Chimiques de St.-Gobain, Chauny & Cirey. September 7th, 1938. (531881.)

26088. "Insulation of electrical apparatus particularly for trolley-buses." General Electric Co., Ltd., and E. H. Croft. September 18th, 1939. (531814.)

1940

17251. "Device for protecting alternating current apparatus against overload and unbalance." Electrical Apparatus Co., Ltd., and R. H. Barbour. June 1st, 1939. (Divided out of 531392.) (531817.)

STOCKS AND SHARES

TUESDAY EVENING.

CONSIDERATIONS connected with the increasing power of the war effort are held to be responsible for a slackening of business in Stock Exchange markets. The inconvenience of being turned out of the House every time that an air-raid warning sounds, is put forward as a reason why the Stock Exchange should remain open until an hour later than the present time of 2 p.m. Whether an extra hour would help to accelerate and increase the daily volume of business, is a matter that arouses lively debate, but that it will come about in due course is certain.

Gilt-edged stocks are amongst the steadiest in the investment groups. Industrials show little change as compared with a week ago. The shadow of taxation, present and to come, is not to be ignored. The latest call-up will reduce the reservoir of man-power that is left at the disposal of business enterprise. In view of all the factors that militate against Stock Exchange markets and prices, the firmness that characterises them is surprising and significant. The nature of the recent buying can be gauged from the fact that frequently it has been easier to deal in a line of shares than in the smaller amounts such as betoken demand from private investors.

Prices Mark Time

Continued good news from Libya and Greece failed to counteract the sentiment of caution induced by invasion possibilities. Appetite for the purchase of Stock Exchange securities is less noticeably keen. When stocks and shares come in for sale, the previous demand for them is found to have diminished. There is no cause for wonder, in these circumstances, to see from the price-lists in the next page that a halt has been called to the advance movement which was an outstanding feature in each of the last two weeks' records of price-changes. The Stock Exchange is marking time.

Shares in the manufacturing and equipment group retain most of their rises, but British Insulated have lost ½ at 4¼ and Callender's are ⅛ down at 63s. 9d. As against these, a gain of 5s. in Lancashire Dynamo lifted the price to 52s. 6d. Reyrolles rose ⅛ to 48s. 9d. and country inquiry for Hopkinsons put them up to 38s. 9d. An excellent report from Westinghouse Brake and Signal failed to move the price from 41s. 3d. to which it rose last week. Cable and Wireless stocks are easier, on sales thought to be for account of profit-takers. The preference and ordinary stocks are 2 points down at 95½ and 55½ respectively.

Colonial and Overseas

Victoria Falls Power ordinary shares strengthened to 72s. 6d., the buyers being undeterred by vague talk of a possible further increase in South African taxation. This talk has produced a dull tone in the shares of mining concerns which take power from the Victoria Falls Company, but it had no effect upon South African industrials. The Indian supply companies' shares remain in favour and in demand. A rise of 1½ in Tokyo Electric sixes left the price at 38½. Brazilian Tractions are lower at 7, Canadian-American interest in them having sunk to a low ebb. Mexican insecurities, upon what appears to be a lessening of the President's intransigeance, are the subject of a little inquiry. Mexican Light and Power 5 per cent. bonds are firm after their rise to 35. (Certain of the Mexican Government bonds which were quoted at ten shillings per £100 not long ago, now stand at the lordly figure of £5.) Canadian Marconis hold their improvement to 5s. It is probable that the major portion of the issued shares are now in Canadian hands. Whitehall Electrics at 14s. 6d. are 1s. to the good.

Home Railway Reaction

The Home Railway market is not so bright as it was. The close approach of the dividend announcements by the companies seems to have induced a feeling of caution lest the declarations should fail to give ground for the optimism which brought about substantial improvements in the prices of Home Railway stocks three weeks ago. Notwithstanding the impediments placed in the way of speculation nowadays by the Stock Exchange system of dealing for cash only—that, at any rate, is the theory—a certain amount of speculative buying did take place, more particularly in the junior stocks, and some of the previous purchasers have evidently decided to take what profits they can secure before the companies announce their dividend figures.

For this reason Southern Railway preferred has fallen 3 points to 48½. London Passenger Transport "C" stock failed to keep step with the advance in other railway stocks. Owing to the modesty of the yield offered by the stock under existing conditions, it did not participate in the favour shown by the speculative spirit that prevailed. The price remains at 34.

County of London Electric

The Kent Electric Power Company, as mentioned here last week, is absorbing two of the smaller companies that operate in the same county, and, as also noted, an impression prevails that this marks a first step towards bringing under one control the various companies in which the County of London Electric holds large interests. In addition to those which it possesses in the three Kent companies, the County of London Electric is substantially interested in the following electricity supply undertakings:—Bournemouth and Poole, South Metropolitan, Weald, Sevenoaks and District, Horley and District, and Folkestone.

For the past nine years, the dividend on County of London ordinary shares has been 10½ per cent. per annum. Owing to the black-out, the evacuation, rising costs and other conditions which have applied particularly to the London electricity supply companies, no surprise will be felt if the final dividend, shortly to be declared, falls below the 7½ per cent. paid a year ago. The interim was maintained at 3 per cent. In view, however, of the leading position occupied by the company, a reduction in the dividend would in no way shake the faith which proprietors of the shares feel in their investment. The price of the shares at 32s. 6d. is 2s. 6d. lower on the week.

Shares on Offer

Readers may well grow weary of the constant reiteration of the phrase that stocks and shares are in short supply. Endeavours are made to show what can be obtained, but these, of recent months, have come to present more than usual difficulty owing to the absorption power of investment. There are still, however, a few preference shares obtainable, or they were obtainable, at any rate, when this was written, and of these half-a-dozen examples are:—

Preference	*Dividend due*	*Price*	*Yield Per cent.*
		s. d.	£ s. d.
200 Automatic Telephone 7%	1 A., 1 O.	30 0	4 13 4
260 Callender's 6½% ..	30 J., 31 D.	30 6	4 5 3
1,000 Crompton Parkinson 8%	June-Dec.	38 4½	4 3 6
100 London Electric Wire 7½%	30 J., 31 D.	30 0	5 0 0
2,500 Telephone Props. 8% ..	1 J., 1 J.	25 0	6 8 0
5,000 United River Plate Tel. 5½%	1 J., A., J., O.	21 0	5 4 9

Of debenture stocks, 5,000 Anglo-Portuguese Telephone 5½ per cent., 1st January and July, is on offer at 97½, yielding £5 12s. 10d. per cent.

Stop Press Prices

Owing to paper restriction, the Stock Exchange Committee has been obliged to curtail very considerably the number of stocks and shares quoted in the Daily Official Lists. It is still incumbent, however, upon members to record the prices at which all their transactions are executed, and special columns in the Stock Exchange lists are now set aside for markings in securities that were removed from their appropriate sections last July. Shareholders in the companies whose securities have been taken out of the list are none the less interested in the current quotations for their shares. The following give an idea of those connected with electric light and power shares that no longer find daily quotation in the Official Lists. The prices are those at which the shares have recently changed hands:—

Lisbon Elec. Trams. 6% pref... ..	18s. 9d.
Direct Spanish Tel. 10% pref. ..	7½
Delhi Elec. Supply and Traction ..	32s. 10½d.
Amazon Telegraph	35s.
Cornwall Power 7% pref.	22s. 3d.
Cawnpore Elec. 7% pref.	25s.
Perak River Hydro-Elec. 5% pref. ..	21s.
London Elec. & Gen. Trust 4½% deb.	98
Mexican Light and Power 7% pref. ..	1

Stock Exchange members are wont to refer to these as "stop press prices." But as the quotations mostly relate to transactions carried out some days ago, the term seems to be hardly accurate.

ELECTRICAL COMPANIES' SHARES

Prices, Dividends and Yields

Company	1940 Highest	1940 Lowest	Dividend Previous	Dividend Last	Middle Price Feb. 3	Rise or Fall	Yield £ s. d.
Home Electricity Companies							
Bournemouth and Poole	63/6	36/6	15	15	47/6	..	—
British Power and Light	30/-	20/-	7	7	27/6	..	5 1 10
City of London	28/-	20/-	7½	7½	22/-	..	—
Clyde Valley	38/6	24/-	8	8	35/-	..	4 11 5
County of London	43/3	21/-	10½	10½	32/6	−½	6 9 3
Edmundson's:							
7% Pref.	32/-	24/3	7	7	28/3	..	4 19 1
Ord.	27/6	18/6	9	6	24/6	..	4 18 0
Elec. Dis. Yorkshire	40/3	32/-	9	9	36/3	..	4 19 4
Elec. Fin. and Securities	42/-	34/6	12½	12½	40/-	..	6 5 0
Elec. Supply Corporation	48/-	39/-	12	11½	37/-	..	6 4 4
Isle of Thanet	16/-	5/6	4	4	6/-	..	—
Lancs Light and Power	33/-	21/6	7½	7½	28/9	..	5 4 4
Llanelly Elec.	21/-	17/-	5½	5½	19/-	..	5 15 9
Lond. Assoc. Electric	21/-	12/6	7	5½	13/9	..	—
London Electric	35/-	19/-	8	7	21/3	..	6 11 9
London Power Deb. Red.	105½	100	5	5	104½	..	4 15 6
Metropolitan	41/6	22/6	12	10	33/9	..	5 18 6
Midland Counties	39/-	23/3	8	8	33/9	..	4 14 10
Mid. Elec. Power	40/-	29/6	9	9	33/9	..	5 6 8
Newcastle Elec.	29/9	22/6	7	7	25/-	..	5 12 0
North Eastern Elec.:							
Ordinary	31/6	16/6	7	7	26/3	..	5 6 9
7% Pref.	32/6	25/6	7	7	30/-	−½	4 13 4
Northampton	44/-	38/-	10	10	40/-	..	5 0 0
Notting Hill 6% Pref. (£10)	10½	9	6	6	9	..	—
Northmet Power:							
Ordinary	42/3	22/6	10	10	33/3	..	—
6% Pref.	29/-	23/-	6	6	28/-	+1/-	4 5 9
Richmond Elec.	24/6	18/-	7	6	18/9	..	—
Scottish Power	38/-	24/-	8	8	34/6	..	4 12 9
Southern Areas	21/3	12/9	5	5	15/-	..	6 13 4
South London	23/3	20/-	7	7	20/-	..	7 0 0
West Devon	20/-	17/6	5	5	20/-	..	5 0 0
West Glos.	22/-	15/-	2½	4½	16/3	..	5 10 10
Yorkshire Elec.	40/-	23/6	8	8	35/-	..	4 11 5
Overseas Electricity Companies							
Atlas Elec.	4/-	1/3	Nil	Nil	2/-	..	—
Calcutta Elec.	37/-	22/6	10*	8*	35/6	..	4 10 2
Cawnpore Elec.	30/-	24/-	10	10	27/6	..	7 5 6
East African Power	25/6	19/6	7	7	22/6	..	6 5 3
Jerusalem Elec.	24/-	15/-	7	7	21/3	..	6 11 9
Kalgoorlie (10/-)	12/6	9/6	7½	7½	12/-	..	6 5 0
Madras	26/9	21/6	8*	6*	25/-	..	—
Montreal Power	35½	30	1½	1½	31	−1	—
Palestine Elec. "A"	25/-	10/-	5*	Nil	20/-	..	—
Perak Hydro-electric	20/3	13/-	2½	6	17/-	..	7 1 2
Shawinigan Power	27½	19	83cts.	90cts.	18½	..	—
Tokyo Elec. 6%	69	30	6	6	38½	+1½	15 11 8
Victoria Falls Power	75/9	56/6	15	15	72/6	+½	4 2 9
Whitehall Investments Pref.	17/9	8/-	7½	7½	14/6	+1/-	10 6 10
Public Boards							
Central Electricity							
1950–70	110½	104	5	5	110	..	4 11 0
1955–75	112½	106	5	5	111	..	4 10 1
1951–73	107½	102	4½	4½	106	..	4 5 0
1963–93	96½	90	3½	3½	95	..	3 13 6
1974–94	91	79½	3½	3½	88½	..	3 13 5
London Elec. Trans. Ltd.	92	87½	2½	2½	93	..	2 15 9
London & Home Counties							
1955–75	113½	105	4½	4½	105½	..	4 5 4
Lond. Passenger Transport:							
A	116	104	4½	4½	111½	..	4 0 9
B	116	102½	5	5	106	..	4 14 4
C	65½	25	1½	1½	34	..	4 8 3
West Midland Joint Elec.							
1948–68	106½	103	5	5	105½	..	4 14 9
Telegraph and Telephone							
Anglo-Am. Tel.:							
Pref.	107	85	6	6	101	..	5 18 10
Def.	23½	18	1½	1½	23½	..	6 7 8
Anglo-Portuguese	22/6	10/-	8	8	15/-	..	10 13 4
Cable & Wireless:							
5½% Pref.	99½	66	4½	5½	95½	−2	5 15 2
Ord.	65	27	4	4	55½	−2	7 4 2
Canadian Marconi $1	6/-	4/-	Nil	4cts.	5/-	..	—
Globe Tel. & Tel.:							
Ord.	32/6	21/6	7½*	6*	26/3	..	4 11 5
Pref.	27/9	22/6	6	6	26/3	..	4 11 5
Great Northern Tel. (£10)	20	11	20	20	12½	..	—
Inter. Tel. & Tel.	5½	2½	Nil	Nil*	3	..	—
Marconi-Marine	30/-	18/3	10	7½	22/6	..	6 13 3
Oriental Telephone Ord.	2½	45/-	12*	11½*	2½	..	4 16 10
Telephone Props.	15/-	11/-	6	6	11/3	..	10 13 4
Telephone Rentals (5/-)	9/6	5/3	10	10	7/3	..	18 0

Company	1940 Highest	1940 Lowest	Dividend Previous	Dividend Last	Middle Price Feb. 3	Rise or Fall	Yield £ s. d.
Traction and Transport							
Anglo. Arg. Trams:							
First Pref. (£5)	4/3	1/-	Nil	Nil	2/-	..	—
4% Inc.	11½	2	Nil	Nil	9	..	—
British Electric Traction:							
Def. Ord.	830	400	5	45	800	..	5 12 6
Pref. Ord.	169	130	8	8	150	..	5 6 8
Bristol Trams	48/6	32/6	10	8*	38/9	..	—
Brazil Traction	12½	5½	$1	50c.	7	−½	—
Calcutta Trams	24/-	16/3	8	5½	19/-	..	5 15 4
Cape Elec. Trams	18/6	16/-	5	5	17/-	..	5 17 8
Lancs Transport	35/-	27/6	10	10	35/-	..	5 14 3
Mexican Light:							
1st Bonds	36	25	5	5	35	..	—
Rio 5% Bonds	95	74	5	5	85	..	5 17 8
Southern Rly.:							
5% Prefd.	79	35	5	5	48½	−3	10 6 2
5% Pref.	104½	59	5	5	87	..	5 15 0
T. Tilling	45/9	29/-	10	10	41/3	..	4 17 0
Tilling & B.A.	47/6	41/9	9*	8*	44/6	..	—
West Riding	35/-	25/-	10	10	34/6	..	5 16 0
Equipment and Manufacturing							
Aron Electricity Ord.	17/6	10/-	15	Nil	16/-	..	—
Assoc. Elec.:							
Ord.	43/3	26/6	10	10	40/-	..	5 0 0
Pref.	36/6	32/3	8	8	35/-	..	4 11 5
Automatic Telephone & El.	47/3	32/-	12½	12½	45/-	..	5 11 1
Babcock & Wilcox	50/-	28/6	10	11	42/6	..	5 13 8
British Aluminium Ord.	56/-	29/-	12½	12½	42/6	..	—
British Insulated Ord.	92/6	67/-	20	20	85/-	+1½	4 14 1
British Thermostat (5/-)	14/9	6/6	18½	18½	11/3	..	8 4 6
British Vacuum Cleaner (5/-)	12/-	4/9	40	12½	6/3	..	10 0 0
Brush Ord.	4/6	1/9	Nil	Nil	3/9	..	—
Callender's	69/-	46/-	15	15	63/9	−½	4 14 4
Chloride Elec. Storage	72/6	55/-	15	15	62/6	..	4 16 0
Consolidated Signal	72/6	59/-	36½	17	65/-	..	5 4 7
Crabtree (10/-)	24/9	17/6	17½	17½	22/6	..	7 15 7
Crompton Parkinson:							
Ord. (5/-)	20/-	12/-	30	20	18/9	..	5 6 8
E. K. Cole (5/-)	5/-	2/6	10	Nil	4/6	..	—
Elec. & Musical Industries (10/-)	10/3	4/3	5	Nil	8/3	..	—
Electric Construction	36/3	27/6	13½	10	27/6	..	7 5 6
Enfield Cable Ord.	56/-	40/6	25	16½	50/-	..	6 10 0
Electrical Switchgear (10/-)	22/6	20/-	16	10	20/-	..	5 0 0
English Electric	33/9	16/6	10	10	30/-	..	6 13 4
Ensign Lamps (5/-)	15/3	12/6	25	25	15/-	..	8 6 8
Ericsson Tel. (5/-)	39/3	23/-	25*	25*	32/6	..	—
Ever Ready (5/-)	28/3	16/6	30	40	27/3	..	7 6 6
Falk Stadelmann	18/3	12/6	6	7	14/6	..	9 13 2
Ferranti Pref.	25/-	22/-	7	7	23/9	..	5 18 0
G.E.C.:							
Pref.	32/6	26/-	6½	6½	31/3	..	4 3 2
Ord.	83/3	53/3	20	20	79/3	..	5 1 0
Greenwood & Batley	25/6	20/-	15	13	20/-	..	13 0 0
Hall Telephone (10/-)	18/6	8/9	15	10	11/3	..	8 18 0
Henley's (5/-)	21/6	12/6	20	20	20/-	..	5 0 0
4½% Pref.	21/2	20/6	4½	4½	21/3	..	4 4 8
Hopkinsons	46/9	32/6	15	15	38/9	+6d.	7 14 10
India-Rubber Pref.	21/-	19/6	.5½	5½	20/-	..	5 10 0
Intl. Combustion	121/3	70/-	32½	30	4½	..	6 9 10
J. Lucas	60/6	40/-	15	15	53/9	..	5 11 6
Johnson & Phillips	50/9	32/6	12½	15	47/6	..	6 16 4
Lancashire Dynamo	59/9	47/6	25	20	52/6	+5/-	7 12 4
Laurence Scott (5/-)	11/-	6/-	15	15	7/-	..	10 14 2
London Elec. Wire	25/6	20/-	7½	7½	22/6	..	6 13 4
Mather & Platt	46/6	30/-	13½	10	37/-	+9d.	5 8 1
Metropolitan Elec. Cable Pf.	22/-	21/3	5½	5½	21/3	..	5 3 6
Murex	86/9	52/6	20	20	81/3	..	4 18 3
Pye Deferred (5/-)	9/-	6/9	25	25	10/-	..	14 5 8
Revo (10/-)	20/9	11/6	17½	5	18/9	..	2 13 4
Revrolle	60/6	41/-	12½	12½	48/9	+½	5 2 6
Siemens Ord.	23/9	15/6	7½	7½	20/-	..	7 10 0
Strand Elec. (5/-)	2/3	9d.	4	2	1/9	..	5 14 4
S. Smith (1/-)	8/-	3/6	37½	50	7/6	..	6 13 4
Switchgear & Cowans (5/-)	11/9	5/6	20	10	8/9	..	5 14 3
Telegraph Condenser (10/-)	8/9	6/3	5	..	7/6	..	—
Telegraph Construction	42/6	29/-	10	10	36/3	..	5 10 6
Telephone Mfg. (5/-)	9/-	5/-	9	9	7/-	..	6 8 7
Tube Investments	96/9	59/-	23½	23½	91/3	..	5 5 0
Vactric (5/-)	3/6	2/-	4	Nil	2/3	..	—
Vickers (10/-)	22/-	9/6	10	10	15/3	−3d.	6 11 2
Ward & Goldstone (5/-)	19/9	12/6	20	20	13/9	..	7 5 6
Westinghouse Brake	46/-	30/6	17½	10	41/3	..	4 17 0
Walsall Conduits (4/-)	26/6	17/6	55	55	26/3	..	8 7 8
West, Allen (5/-)	7/-	3/-	7½	10	3/9	..	10 0 0

*Dividends are paid free of Income Tax.

CONTRACT INFORMATION

Particulars of work for which tenders are invited, contracts placed, and building schemes promising work for electrical contractors and traders

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses. Further details of items marked with an asterisk can be obtained from the Department of Overseas Trade (Inquiry Room), Millbank, Westminster, London, S.W.1.

Belfast.—February 28th. Electricity Committee. Stores. (See this issue).

Bootle.—Corporation. Materials for six, or alternatively twelve months, including electric lamps (schedule No. 14). Forms of tender from W. A. Harrison, borough engineer, Town Hall.

Dundee.—February 12th. Electricity Department. Transformers for low-voltage lighting. (January 31st.)

Durham.—County Education Committee. —Electrical installation in connection with additions to Easington Colliery Senior Boys' and Girls' Council School. Plans by F. Willey, 34 Old Elvet.

Leeds.—February 14th. Electricity Department. Stores for twelve months. (January 31st.)

Luton.—February 10th. Borough Council. Installation of lighting in tunnel shelter. (January 31st.)

Manchester.—February 27th. Electricity Department. Fire extinguishing equipment for switchgear, transformers, &c. (See this issue.)

Salford.—February 20th. Electricity Department. Stores. (See this issue).

South Africa.—PRETORIA.—March 13th. Transformers, h.v. and l.v. switchgear. (T.15287/41.)*

PORT ELIZABETH.—March 13th. Municipality. One battery-driven tower wagon and one battery-driven van. (T.15013/41.)*

Electric lamps and cable conduit. (T.15014/41.)*

Southern Rhodesia.—SALISBURY.—March 10th. City Electricity Department. 374 meters of various types. (T.23645/40.)* Electrical distribution material. (T.Y.15136/41.)*

Stores Department. March 28th. Electrically driven rendering vessel, etc., for municipal abattoir. (T.15135/41.)*

Stoke-on-Trent.—February 12th. Electricity Department. Mains and cables, e.h.v. substation switchgear and transformers. (January 24th.)

Wakefield.—February 17th. Supply and erection of three-wire balancer for generating plant at Wakefield mental hospital. W. E. H. Burton, Victoria Chambers, Wood Street, Wakefield (P.O. Box 28).

Weston-super-Mare.—February 10th. Town Council. Automatic boosting equipment required in connection with water supply scheme, comprising two sets of 2,500 g.p.h. booster pumps, one set electrically driven and one by Diesel engine. Particulars from and tenders to H. A. Brown, borough engineer, Town Hall.

Wolverhampton.—March 17th. Electricity Department. Paper insulated cables, compound and compounded insulating tapes. (See this issue.)

Orders Placed

Burnley.—General Purposes Committee. Recommended. Installation of "Ripplay" system of centralised control (£1,776). —Metropolitan-Vickers.

Enfield.—Education Committee. Accepted. Electric lighting, heating and ventilating at school shelters (£3,650).—Norwest Services.

London.—LEWISHAM.—Emergency Committee. Recommended. Galvanised steel conduits, wiring, switches, etc., for heating public shelters (£964).—Drake & Gorham, Ltd.

Sheffield.—Electricity Committee. Accepted. 5,000 kVA auxiliary transformer (£2,752).—Metropolitan-Vickers Electrical Co.

West Midlands.—Joint Electricity Authority. Accepted. Supply, laying, and testing of standard frequency h.v. and l.v. AC cables, and l.v. DC cables at Wolverhampton generating station.—Callender's.

Woolwich.—Electricity Committee. Accepted. P.i. cables for one year.—Siemens Bros. & Co.; Standard Telephones and Cables.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Ayr.—Factory, Beavan's Garage; London Metallic Capsule Co., Ltd., 392, Rotherhithe Street, Bermondsey, S.E.16.

Barking.—Demolition and rebuilding of girls' hall, Erkenwald School, for E.C.; borough engineer, Town Hall, Barking.

Barnsley.—Adaptation of 1 and 3, St. Mary's Gate for police buildings extension, for T.C.; A. E. Gilfillan, town clerk, Town Hall.

Loom erecting shop at foundry; Wilson & Longbottom, Ltd.

Beswick.—Works alterations, Holt Town; W. Dickinson, architect, 113, Ellenbrook Road, Boothstown, Walkden.

Billesdon.—Fire stations, for R.D.C.; S. Shimmins, surveyor, Thurnby, Leicester.

Blackley.—First-aid department, Hendham Vale, for Small & Parkes; H. S. Fairhurst & Son, architects, 55, Brown Street, Manchester.

Boughton (Northants).—Houses (10), Green Hills Road; Amalgamated Engineering Union.

Bristol.—Adaptation of unused sanatorium as hospital, with engineering services replacements, &c., for T.C.; borough engineer, 63, Queen Street.

Bromsgrove.—Houses, Beoley, Clent, Cofton Hackett and Belbroughton, for R.D.C.; S. A. Price, building surveyor, Rural Council Offices.

Communal feeding and kitchen centre at Ebenezer Schools, Sidemoor, for U.D.C.; F. W. Goodman, surveyor, The Council House.

Works extensions, Gas Square; Bromsgrove Mineral Water Co., Worcester Street.

Bursiem.—Additions, Clyde Colour Works, Victoria Street; J. Davies, Ltd.

Chester.—Workshop, Boughton; Chester Engineering Co., Ltd.

Chesterfield.—Conversion of Brambling House as hospital annexe (100 beds); Secretary, Chesterfield and Derbyshire Royal Hospital, Newbold Road.

Alterations, Grammar School for Derbyshire (£2,550); J. Harrison, county architect, County Offices, St. Mary's Gate, Derby

Chester-le-Street.—Inn, Waldridge, for C. Vaux & Son, Castle Street, Sunderland.

Communal feeding centre, Birtley, for R.D.C.; M. Wilson, R.D.C. offices.

Darlaston.—Day nursery at Slater Street Methodist Schools for U.D.C. (Electrical work); N. H. Hughes, surveyor, Town Hall.

Darlington.—Generating shed, Feethams, for A. Newsome; J. E. Chilton, architect, 44, Tubwell Row.

Financial Section (*Concluded from page 354*)

Tib Lane, Manchester, to receive an account of the winding up by the liquidator, Mr. W. P. Masterson.

Thomas Jennings & Sons, Ltd.—Winding up voluntarily. Liquidator, Mr. A. Dobson, Permanent House, The Headrow, Leeds.

Bankruptcies

H. Rose (Rose Electrical Services), 158, Soho Road, Handsworth, Birmingham.—Receiving order made January 17th on a creditor's petition. Public examination February 27th, at the Court House, Birmingham.

C. T. Hicks, electrical engineer and contractor, 81, High Street, Witney.—Trustee, Mr. J. B. Simmons, 8, Forbury, Reading, Official Receiver, released January 11th.

J. C. DeWardt (DeWardt Radio), radio and electrical engineer, 10, Windmill Street, Gravesend.—Trustee, Mr. A. H. Partridge, 3, Warwick Court, Gray's Inn, London, W.C.1, released December 17th.

J. O. D. James, electrician, 102, Chepstow Road, Newport.—First and final dividend of 2s. 7½d. in the £, payable February 21st, at 34, Park Place, Cardiff.

F. W. Scott, radio and electrical dealer, 106, Leeds Road, Outwood, near Wakefield.—Trustee, Mr. B. S. Briggs, 13, Burton Street, Wakefield, Official Receiver, released January 11th.

H. Truett, electrician, 13, Elmwood Avenue, Baldock, Herts.—Receiving order made January 24th on a creditor's petition.

J. J. Glover, electrical contractor, 24, Market Place, Reading.—Trustee, Mr. J. B. Simmons, 8, Forbury, Reading, Official Receiver, released January 22nd.

Private Arrangement

J. Lea, electrical engineer, late Moston Lane, Moston, Manchester.—The creditors interested met recently. No statement of affairs was submitted, but it was reported that the liabilities totalled £168, all due to the trade. The debtor had no assets. The business, it was stated, was commenced in August, 1935, the debtor's capital being £100. The trading was successful for a time, the sales averaging £30 a week. The drawings had never exceeded £4 weekly. A number of creditors had commenced proceedings. It was stated that friends of the debtor were prepared to find sufficient to pay a composition of 2s. in the £ to the creditors.

Derbyshire.—Shelter and feeding centres (£21,280), for C.C.; county architect, St. Mary's Gate, Derby.

Dun Laoghaire.—Building for joint purposes of public library and domestic science school, Carysfort Road, Dalkey, for T.C.; T. C. O'Mahony, borough manager, Town Hall.

Ealing.—Temporary school, West Twyford (£1,050), for E.C.; C. W. Seddon, borough engineer, Town Hall.

Edinburgh.—Communal restaurant, for T.C.; D. Robertson, town clerk, City Chambers.

Enfield.—Factory, Great Cambridge Road; Standard Proofing Co., Ltd.
Factory extension, Alexandra Road; Mr. L. J. Middleton.

Felling-on-Tyne.—Ten emergency feeding centres, for U.D.C.; surveyor, Council Offices.

Gateshead.—Alterations, &c., Albert Inn, Forster Street, for Ridley, Cutter and Firth; Hetherington & Wilson, architects, County Chambers, Westgate Road, Newcastle.

Hanley.—Additions, Falcon Pottery, High Street; J. Weatherby & Sons, Ltd.

Haslingden.—Housing scheme, for T.C.; borough engineer.

Higham Ferrers.—Fire station for T.C.; A. E. Lloyd, borough surveyor, Town Hall.

Holsworthy.—Booster pump for improving water pressure, for U.D.C.; clerk, Clerk's Office, 8, Fore Street, Holsworthy, Devon.

Hull.—Repair depots and rescue and decontamination centres (£5,569), for T.C.; Quibell & Son, Ltd., builders, 354, Beverley Road.

Lanarkshire.—Community kitchens and feeding centres, for C.C.; county architect, Albert Street, Motherwell.

Leicester.—Laboratory and operating theatres, City General Hospital, for Health Committee; E. J. Williams, architect, 13, New Street.

London.—LEWISHAM.—Extensions, South depot (£4,839); Henry Kent (Builders), Ltd.
PADDINGTON.—Rest centres; borough engineer.
WANDSWORTH.—Distributive dairy depot, Pirbright Road, Fairfield; A. Duckworth.

Longton (Staffs).—Additions, Caroline Street; Belstaff Manufacturing Co.
Warehouse, Tuscan Works, Forrister Street; R. H. and S. L. Plant.
Depot (£2,160); G. and J. Seddon, Ltd.

Manchester.—Houses, Wythenshawe and other estates, for Housing Committee; J. Hughes, housing director, Town Hall.

Maryport.—Houses (50) for U.D.C.; surveyor, Town Hall.

Middlesbrough.—Adaptation of Crathorne Hall as auxiliary hospital for T.C.; borough engineer.

Morley.—Extensions to works, Bridge Street; Richardson & Co. (Leeds), Ltd., woollen manufacturers.

Newcastle-on-Tyne.—Proposed ice rink (£35,000), Warwick Street; Portland Ice Rink, Ltd.

Northampton.—Boiler house additions, Wellingborough Road; Manfield & Sons, Ltd.
Reconstruction, dairy, Ransome Road; Northampton Co-operative Society, Ltd.

Northenden.—Works extensions, Sharston Road, for Edward Wilcox & Co.; A. A. G. Toone, architect, 19, Chapel Walks, Manchester.

Northwich.—Community feeding and kitchen centres, for U.D.C.; H. Grantham, clerk, The Council House.

Openshaw.—Warehouse, Ogden Lane, Grey Street and Botha Street, for Lindsay & Williams; Wrathmell & Blackshaw, architects, Queen's Buildings, St. Peter's Square, Stockport.

Preston.—Canteen and rest room, Church Street and Derby Street, for Catholic Societies; R. Rawstorne, secretary, 11, Chapel Street.

Rawtenstall.—Alterations, &c., Wood Vale Mills, Waterfoot; T. Aitken & Sons, Ltd.

Rochdale.—Rebuilding the "Black Dog" Hotel, Hooley Moor Road, Lanehead; Rochdale and Manor Brewery, Ltd., The Brewery, Molesworth Street.

Rusholme.—Rebuilding the "Whitworth" Hotel, Moss Lane East, for Taylor's Eagle Brewery Co., Ltd.; R. S. Litherland, architect, 8, Fountain Street, Manchester.
Commercial garage, Lloyd Street; Rusholme Light Car Co., Lloyd Street.

Salford.—Additional accommodation, Hope Hospital; W. A. Walker, city engineer, Town Hall.

Shipley.—Additions, Dockfield Road; Hepworth & Grandage.
Two shops, Kirkgate; F. J. Holdsworth.

Shrewsbury.—Extensions, cookery centre, Harlescott Municipal Schools for E.C.; A. W. Ward, borough surveyor, Guildhall.

South Bank-on-Tees.—Boys' club (£600) for the Yorkshire Association of Boys' Clubs; secretary of Association, Leeds.

Stafford.—68 houses, Electrical work (£1,340), Silkmore Estate, for Housing Committee; Sabin & Young, Ltd. builders, Pelsall Road, Rushall, Walsall.

Stoke-on-Trent.—Alterations, Stafford Street; Cardigan Estates, Ltd.

Tunstall.—Depot (£1,796); Naylor & Nutt.

Tynemouth.—Garage and store, near Priory School, for T.C.; borough engineer.
Municipal cafe, Jubilee Schools (£1,740); borough engineer.

Urmston.—Garage, Highway Depot, Bowfell Road, Flixton, for U.D.C.; E. L. Leeming, engineer and surveyor, Council Offices, Crofts Bank Road.
Community feeding and kitchen centre, Moorside Road, for U.D.C.; E. L. Leeming, surveyor, Council Offices, Crofts Bank Road.
Houses, Snowden Avenue, and reconditioning 10 houses, for U.D.C.; E. L. Leeming, surveyor.

Wakefield.—Community feeding and kitchen centres, and rest centres for 3,000 persons; S. G. Wardley, city engineer, Town Hall.

Warrington.—Emergency hospital theatre block at sanatorium, for T.C.; borough surveyor, Bank Park.

Watford.—Works, Colne Valley Road; Peter Spence & Co., Ltd.

Wigan.—Office premises, off Elmfield Road; Prudential Assurance Co., Ltd.

Workington.—Communal feeding and cooking centres; reinstatement of houses, several streets; and 17 communal surface shelters; A. B. Cooper, borough surveyor, Town Hall.

Wrexham.—Extensions, Public Abattoir, Crescent Road, for T.C.; John Hughes (Contractors), Ltd., Holt Street.

CORRESPONDENCE

Every letter must be accompanied by the writer's name and address preferably, but not necessarily, for publication. The Editors cannot accept responsibility for correspondents' opinions.

Unarmoured Cables

REGARDING the article by Mr. R. W. L. Phillips in your issue of January 10th, I would suggest that his conclusions relate to supply undertakings only, as opposed to heavy industrial applications.

Mr. Phillips remarks that no alloy was used in the lead covering of the cables at Bedford, but in industries such as the one in which I am interested, heavy impact blows are impressed upon foundations and transmitted to the surrounding buildings, floors and roadways. This makes it necessary, in order to prevent crystallisation of the lead due to vibration, to alloy the lead with about 1 per cent. of antimony.

In installations under the Coal Mines and Quarries Regulations, it is difficult to omit armouring in all cases and at the same time comply with the requirement that the metallic covering of all cores shall have a conductance of not less than half of the same length of the largest of the live conductors enclosed therein.

In general, however, I agree that armouring can be omitted if sufficient care, as detailed by Mr. Phillips, is taken in the laying and positioning of cables.

WM. CRAIG, B.Sc. (Eng.), A.M.I.E.E.

Farnham Royal, Bucks., *January 29th.*

Glass Bulb Rectifiers

THE letter appearing in your issue dated January 17th is interesting and we wish to support the remarks made by your correspondent, for we, too, have absolute confidence in the ability of the glass bulb rectifier to stand up to the conditions produced by aerial warfare.

While our confidence has not been established by an experience exactly similar to that which proved the complete faith expressed by the Electric Construction Co., we do know of a number of instances in which glass bulb rectifiers have suffered no damage, in spite of the fact that high explosive bombs have exploded in close proximity to them.

In one instance worthy of particular notice, enemy action was responsible for the partial burying in the ground of the rectifier cubicles and their associated transformers, but even then not all of the bulbs suffered damage. A further instance concerns a substation housing 200 kW of glass bulb rectifiers of our manufacture, when as the result of enemy action, the substation building was so damaged as to render complete rebuilding necessary, but the rectifier bulbs were undamaged.

Croydon, *January 28th.*

NEVELIN ELECTRIC CO., LTD.
J. W. PERKINS, *Sales Manager.*